SAY GOODBYE TO DULL ROUTER BITS

Woodsmith®

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Vol. 31 / No. 181

Woodsmith 30 YEARS 1979 - 2009

CLASSIC TRESTLE TABLE

- Simple Joinery
- Breadboard Ends
- Drop-In Leaves

INSIDE:

The 1st Steps to a Perfect Finish

Beyond Yellow Glue: Specialty Adhesives

Master Craftsman Techniques for Better Case Construction

A Publication of August Home Publishing

Table of Contents

from our readers
Tips & Techniques 4

all about
Beyond Yellow Glue. 8
There's a type of glue for every woodworking task. Here's what you need to know.

tools of the trade
Insert Router Bits 10
We'll take a look at a new, innovative option in router bits offered by *Amana*.

techniques from our shop
Mitered Bridle joint 12
Learn a great table saw technique that results in strong, easy-to-assemble mitered frames.

jigs and fixtures
Bench Grinder Tool Rests 14
Turn your bench grinder into a precision sharpening station by upgrading the tool rest.

tips from our shop
Shop Notebook 26

woodworking technique
Hand-Cut Dadoes 44
With a handful of basic tools and a time-tested technique, you can cut first-class dadoes.

finishing room
Perfect Surface Preparation. 46
When it's time for a finish, this four-step process guarantees you start off on the right foot.

details of craftsmanship
Dovetails in Case Construction 48
Dovetails aren't just for drawers. Find out how to put case dovetails to work in your projects.

in the mailbox
Q & A 50

hardware and supplies
Sources 51

Mantel Clock page 16

Trough-Style Bookrack page 20

projects

weekend project

Mantel Clock 16

This project proves that a small clock can still have "grandfather" details. You'll be in and out of the shop in a weekend, but your clock will be treasured for a lifetime.

designer series project

Trough-Style Bookrack 20

This project certainly doesn't have the look of your run-of-the-mill bookrack. The light, open design makes for great "anywhere" storage and some challenging woodworking.

heirloom project

Trestle Table 28

The trestle-style dining table brings together the old and the new in a great project. The design is classic, while the construction and the expandable feature are more up to date. DESIGNER'S NOTEBOOK

shop project

Handsaw Till 38

A shop project should be practical. But that doesn't mean you can't show off your woodworking skills. Building this traditional handsaw till will give you the best of both.

Trestle Table page 28

editor's note
Sawdust

Woodsmith 30 YEARS 1979 · 2009

This issue of *Woodsmith* marks our 30th anniversary. And looking back, it's amazing to see how much the magazine has changed since that very first issue. There are more pages, color photography, computer-generated art, and of course, a whole new group of faces who put the magazine together. But one thing hasn't changed, and that's our main focus — to provide clear, detailed, easy-to-follow project plans that anyone can build. This objective is just as important today as it was thirty years ago.

With that in mind, we've borrowed an idea from the past for one of the projects in this issue. The first issue of *Woodsmith* included plans for building a trestle table. After 30 years, I thought that it just might be time to feature another one. Like the table in issue No. 1, this table has a sturdy, trestle-style base and a top with breadboard ends. What makes this table different is what you *don't* see. Instead of a fixed, solid-wood top, the table in this issue has a plywood top with breadboard ends that pull out to make room for a couple of extension leaves. But don't worry if this sounds complicated. Just like in that first issue 30 years ago, we've included all the steps and details you'll need to build the project.

Terry

Handsaw Till page 38

Tips & Techniques

Precision Drilling Jig

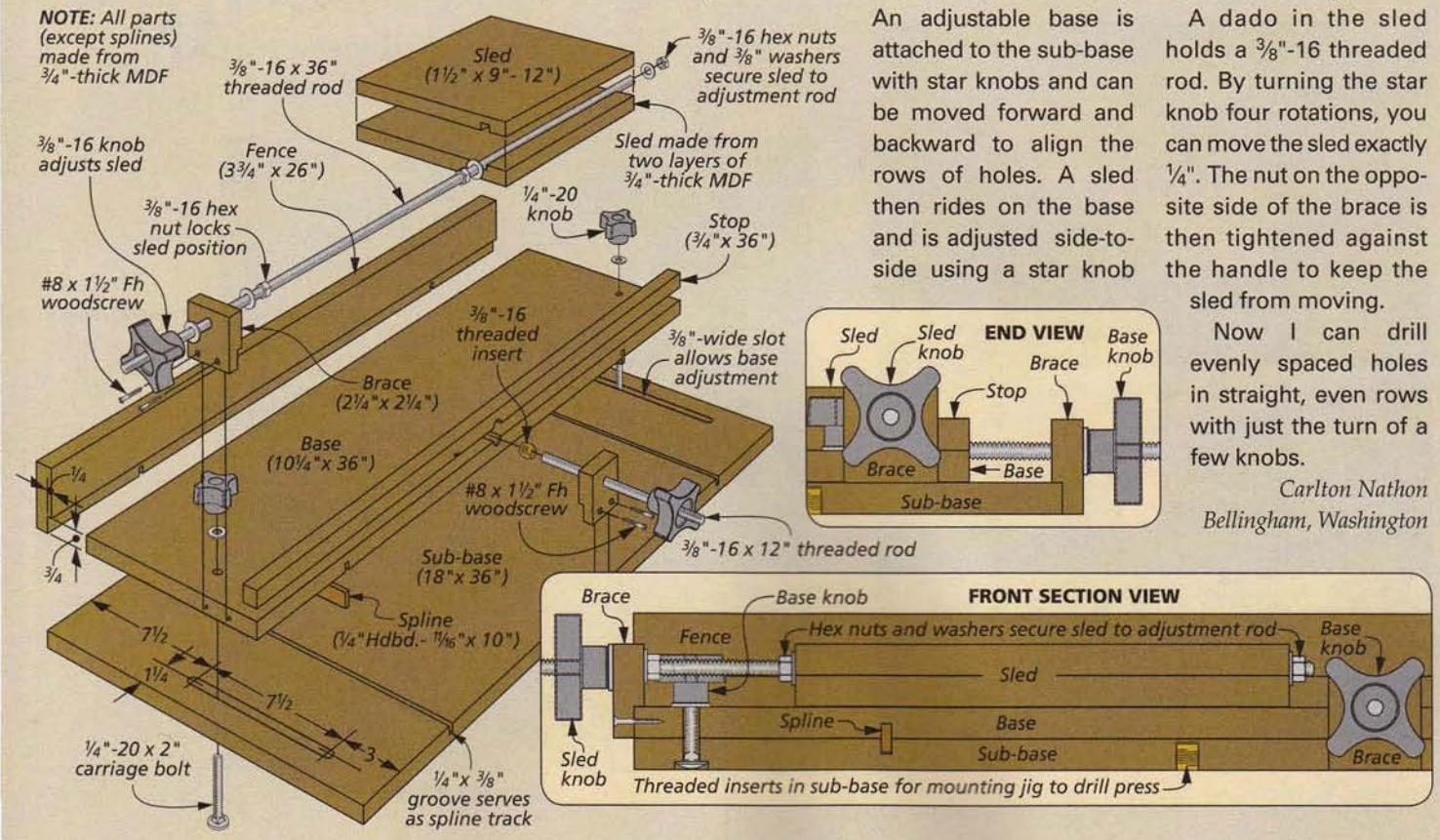
I make a lot of cribbage boards in my shop. Marking and drilling the holes in each board by hand was always a time consuming task. So I built a drilling jig like you see in the main photo.

The jig consists of a sub-base that bolts to a drill press table (see Side Section View). An adjustable base is attached to the sub-base with star knobs and can be moved forward and backward to align the rows of holes. A sled then rides on the base and is adjusted side-to-side using a star knob on a section of threaded rod. The workpiece is attached to this sled with double-sided tape.

A dado in the sled holds a 3/8"-16 threaded rod. By turning the star knob four rotations, you can move the sled exactly 1/4". The nut on the opposite side of the brace is then tightened against the handle to keep the sled from moving.

Now I can drill evenly spaced holes in straight, even rows with just the turn of a few knobs.

Carlton Nathon
Bellingham, Washington

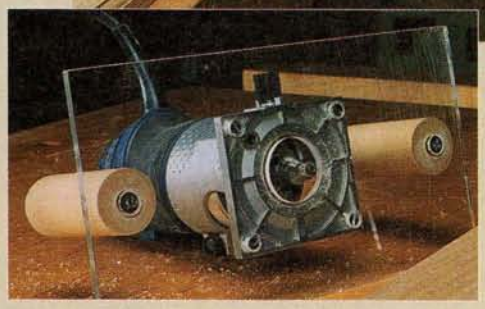


Trim Router Base

A trim router is a great tool to have in the shop. Its small size allows you to use it with one hand and to get into tight spaces. But there are times when the small base of a trim router doesn't offer quite enough support.

To make my trim router more stable, I added a larger auxiliary base, like you see at right. It's cut from a ¼"-thick piece of acrylic and attached using the original screw locations. To make the router easier to control, I added a pair of dowels as handles (inset photo).

Serge Duclos
Delson, Québec



Finishing Jig for Table Legs

I find it easier to apply finish to table legs or spindles before assembling a project. But keeping the workpieces off the bench while they dry is a challenge.

So I built a jig (photo below) that will hold legs or spindles of any length. It's just two, L-shaped brackets with evenly spaced holes for some finish nails. The finish nails are inserted through the brackets and into the ends of the legs.

Now I have a convenient way to apply finish and allow it to dry in the same jig.

Arnold Griffee
Henderson, Kentucky

SUBMIT YOUR TIPS ONLINE

If you have an original shop tip, we would like to hear from you and consider publishing your tip in one or more of our publications. Go to:

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You'll be able to tell us all about your tip and upload your photos and drawings. You can also mail your tips to *"Woodsmith Tips"* at the editorial address shown at right. We will pay up to $200 if we publish your tip.

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Woodsmith

No. 181 February/March 2009

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Woodsmith® (ISSN 0164-4114) is published bimonthly (Feb., Apr., June, Aug., Oct., Dec.) by August Home Publishing Company, 2200 Grand Ave, Des Moines, IA 50312.
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Subscriptions: Single copy: $4.95. One year subscription (6 issues), $24.95. (Canada/International add $10 per year, U.S. funds.)
Canadian Subscriptions: Canada Post Agreement No. 40038201. Send change of address information to PO Box 881, Station Main, Markham, ON L3P 8M6.
Canada BN 84597 5473 RT
Periodicals Postage Paid at Des Moines, IA, and at additional offices.
Postmaster: Send change of address to *Woodsmith*, Box 37112, Boone, IA 50037-2112.

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EDITORIAL
Woodsmith Magazine
2200 Grand Avenue
Des Moines, IA 50312
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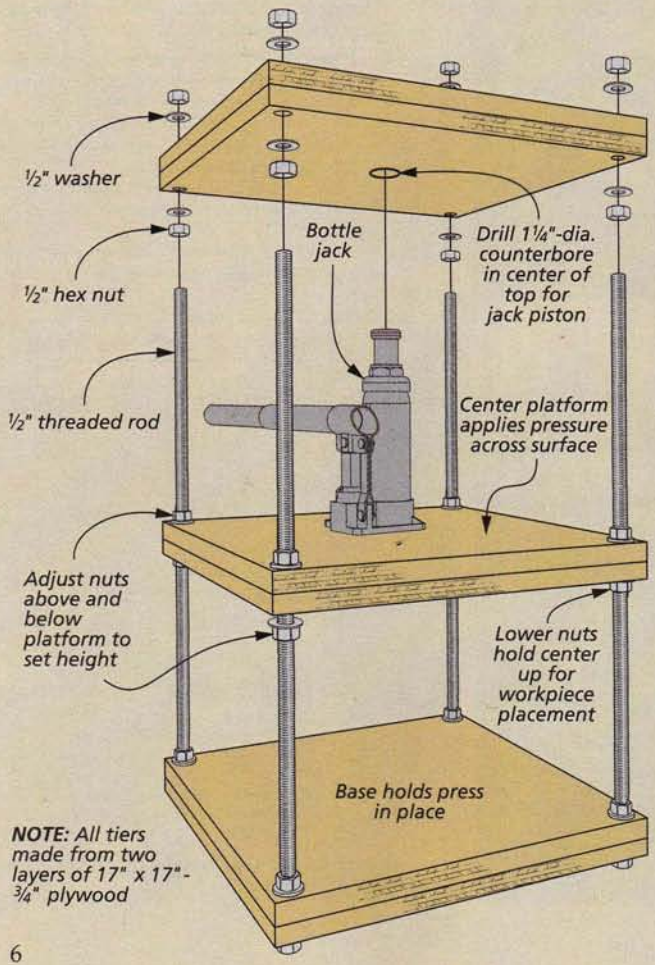
AUGUST HOME PUBLISHING COMPANY

Printed in U.S.A.



Hydraulic Gluing Press

I make a lot of segmented and laminated bowls. I was using clamps to glue up the blanks, but I never seemed to be able to get good pressure at the center. So I came up with the gluing press you see in the photo above.

The press is made up of three plywood "tiers" mounted on threaded rods. I used two layers of plywood in each tier to prevent them from flexing under pressure.

A hydraulic bottle jack provides the clamping pressure. (You can find bottle jacks at most home improvement stores.) The threaded rods and nuts offer additional pressure at the corners of the press.

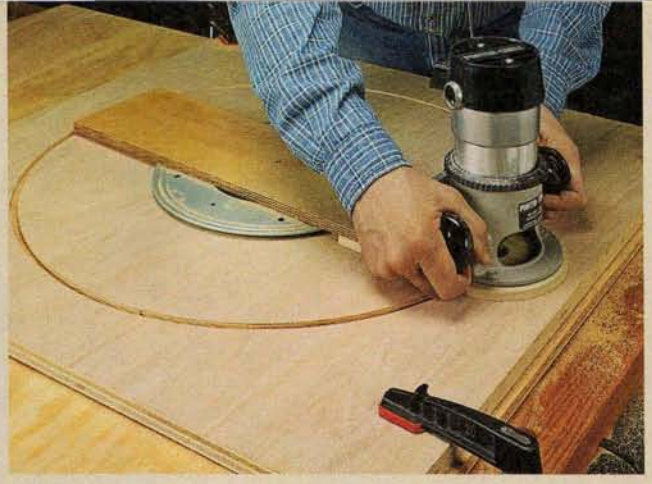
As you can see in the drawing at left, it's a pretty simple jig to make. After the blanks are glued up and cut to size, drill a hole through each corner of all three tiers.

I also drilled a shallow hole in the center of the top tier for the piston of the jack. This keeps the jack from slipping as the pressure is applied. Then you can add the threaded rods, threading on the nuts and washers for each tier as you go along.

Using the press is just as simple as the assembly. Start by placing your workpieces between the base and the platform holding the jack. Back off the hex nuts under the platform so it rests on your workpiece. Then start applying pressure with the bottle jack until you begin to notice glue squeeze-out. Finally, snug up the hex nuts above the platform to apply pressure at the corners.

Nelson Benton
Hastings, Nebraska

Lazy Susan Router Trammel



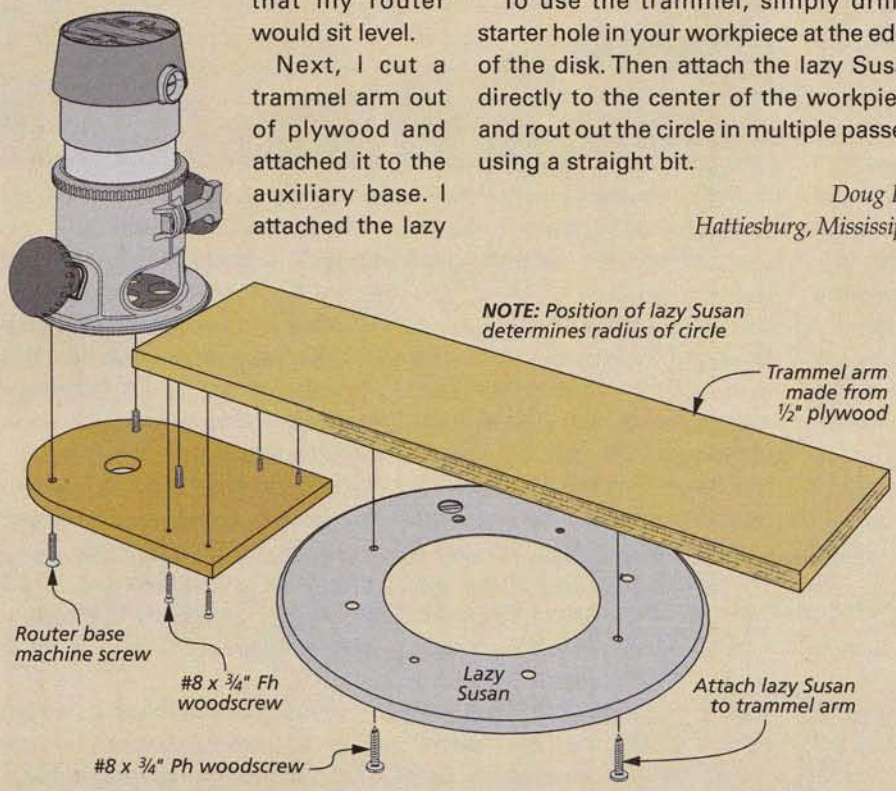
Recently, I was building a cabinet with a lazy Susan and I needed to cut out a large, plywood circle for the turntable. While scratching my head trying to figure out how I was going to do this, it dawned on me that I could use the lazy Susan to make a trammel for my router.

First, I mounted the router to an auxiliary base (see drawing). I made the base the same thickness as the lazy Susan so that my router would sit level.

Next, I cut a trammel arm out of plywood and attached it to the auxiliary base. I attached the lazy Susan to the other end of the trammel arm. (The distance between the router bit and the center of the lazy Susan should equal the radius of the circle.)

To use the trammel, simply drill a starter hole in your workpiece at the edge of the disk. Then attach the lazy Susan directly to the center of the workpiece and rout out the circle in multiple passes, using a straight bit.

Doug Lee
Hattiesburg, Mississippi



Win This Bosch *Impactor* Driver

That's right, send us your favorite shop tips. If your tip or technique is selected as the featured reader's tip, you'll win a *Bosch* impact driver just like the one shown here. To submit your tip or technique, just go online to *Woodsmith.com* and click on the link, "SUBMIT A TIP." You can submit your tip and upload your photos for consideration.

The Winner!

Congratulations to Carlton Nathon, winner of the *Bosch Impactor* driver. To find out how you could win a Bosch driver, check out the information on the left.

Quick Tips

PLASTIC LIDS AS GLUE TRAYS

I found that plastic lids from disposable containers make good glue trays. Plus using a tray like this helps me conserve glue.

The rim on the lid prevents spills and provides a nice edge to rid the brush of excess glue. And I now have a handy place to set my glue brush during glueups.

Cleanup is easy, too. Since dried glue won't stick to plastic, I just give the lid a twist and the leftover glue pops off into the trash.

Jayne Thorson
Ann Arbor, Michigan

BUNGEE CORD HOLD-DOWN

Securing oddly shaped workpieces to your workbench can be a challege. But I found that a bungee cord with hooks works nicely.

Fold a bungee cord so the hooked ends meet and bring the folded end up through a dog hole in the bench. The hooks will stop the cord from pulling through and you'll have a flexible loop that can be wrapped around any size workpiece.

Try different lengths of bungee cord or multiple loops for greater versatility and holding power.

Sal Giambruno
La Verne, California

SMALL CHUCK ON THE DRILL PRESS

I recently took up scroll sawing as part of my woodworking hobby. But some of the drill bits I used to drill starter holes were too small to chuck up in my ½" drill chuck.

To solve this problem, I bought a small, ¼" chuck and threaded it onto the end of a ⅜" bolt. Then I cut off the head of the bolt and inserted it in the larger chuck.

With this smaller chuck, it's much easier to chuck up small drill bits. And when I need my drill press for big jobs, I can remove the smaller chuck from the ½" drill chuck as easily as changing drill bits.

Dane Rodgers
Noblesville, Indiana

beyond Yellow Glue

Choosing the right adhesive for your projects will help make sure they last a lifetime.

▲ Polyurethane glue reacts with water while it's curing and will foam out of the joint while the project is clamped up. The dried foam squeeze-out is easily removed with a sharp chisel or scraper.

When it's time to glue up a project, I usually reach for a bottle of yellow PVA (polyvinyl acetate) glue. And for most common woodworking tasks that's the right call. But if you've checked out the glue section at your local hardware store or home center lately then you'll know that there are a lot of other glues on the market. Some boast better holding power, others are designed for different applications. The choices can be overwhelming.

The truth is, in spite of the number of different brands, most woodworking glues fall into only a few distinct types. Knowing the strengths and weaknesses of each type can help you choose the best adhesive for a project.

CYANOACRYLATE

One type of glue that gets a lot of use in my shop is cyanoacrylate, often sold as "super glue." The high cost of cyanoacrylate makes it impractical for assembling woodworking projects, but it has some unique properties that make it very useful.

First, it bonds in a matter of seconds. This makes it handy for quick repairs, like a split in a workpiece. Second, it bonds dissimilar materials, like wood and metal. Finally, it's available in thin, medium, and thick viscosity so you can select the right version for any task.

While cyanoacrylate bonds very quickly, you can speed up the bond by using an accelerator. Just spray it on the workpiece and cyanoacrylate hardens almost instantly. Fortunately, cyanoacrylate debonders are also available for correcting mistakes or saving your skin if you glue your fingers together. (Let's be honest, everybody's done this at least once.)

POLYURETHANE

Polyurethane glue has become second only to PVA in popularity and can be found just about everywhere glue is sold. For outdoor projects, or anything that will be exposed to water or moisture, polyurethane is a great choice. When applied properly, it provides roughly the same strength as PVA.

Polyurethane glues need moisture to cure properly. You'll get the strongest bond if you dampen the surfaces to be joined before adding the glue. As the glue cures, it produces a light-colored foam at the glue line. It's best to let the foam dry before trying to remove it. If you try to scrape it away while it's still wet you'll probably just end up with

Cyanoacrylate glues

▲ Cyanoacrylate glue is a great choice for bonding dissimilar surfaces like this brass hinge pin for a box lid.

▲ Epoxy can be tinted and used to fill voids or knot holes.

a mess. After it's dried, it's easy to slice the bead off with a sharp chisel (main photo at left).

I usually use latex gloves when working with polyurethane because it's messy and tougher to clean up than PVA.

EPOXY

When you need a glue that provides an absolutely waterproof bond, the top choice is two-part epoxy. Epoxy is usually sold as paired individual components: a resin and a hardener. One of the nice things about epoxy is that you can use different resins and hardeners to adjust the working time and viscosity. When mixed in the proper ratio, a chemical reaction turns the two components into a gel-like glue that will bond just about anything.

To mix epoxy, you'll find it helpful to fold the two components together using a tongue depressor or a piece of scrap wood. This works better than trying to stir the thick components. You can mix epoxy in disposable containers or simply on a scrap piece of stock. It's thick enough that it won't run off the edges.

It's also a great choice if you need a gap-filling adhesive. In fact, as you can see in the photo above, I often use it to fill knots. By adding a little pigment or sawdust you can even match (or contrast) the color of the wood.

There's also another two-part glue to consider for some special applications. I like to use urea formaldehyde glue for bent laminations. You can find out why and how to use it in the box below.

These adhesives won't replace yellow glue, but once you understand their capabilities, they can open up a lot of possibilities. W

Another Option: Urea Formaldehyde

When it comes to gluing up a bent lamination, yellow glue will work, but you can expect some springback due to the elasticity of cured PVA glue. When you need to avoid the "creeping," there's another glue I like to use — urea formaldehyde. This adhesive dries hard enough to prevent the tension in the individual laminates from distorting the overall shape, so the workpiece doesn't spring back.

On the downside, urea formaldehyde requires a few precautions. As you might imply from the name, urea formaldehyde contains some toxic elements. So you'll want to wear a high-quality respirator when mixing and applying it, and avoid getting it on your skin.

There are several different types, but the one I prefer comes in powder form and mixes easily with water. It provides over 30 minutes of working time and you can spread it with a disposable brush. One more thing to consider before using urea formaldehyde is the temperature in your shop. For best results, the shop temperature should be between 70° and 90°.

replaceable-insert Router Bits

Tired of sharpening or throwing away router bits when they get dull? Amana's new line offers an innovative solution to an old problem.

There aren't many projects in my shop that don't get some treatment from a router. Whether it's adding an edge profile or cutting a mortise, the router is a go-to tool.

The problem is router bits have a limited lifespan. Don't get me wrong, modern, tungsten-carbide edges hold up pretty well. But when they start to dull, you need to sharpen or replace them. And both options have a downside.

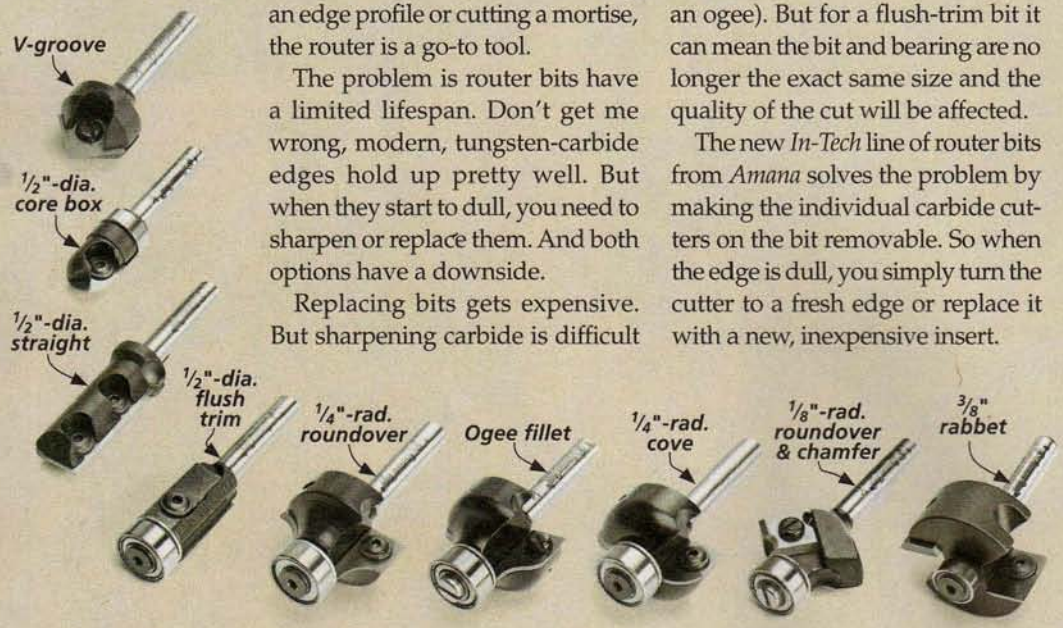
Replacing bits gets expensive. But sharpening carbide is difficult and can change the diameter as the carbide is honed. This isn't as big a concern for certain profile bits (like an ogee). But for a flush-trim bit it can mean the bit and bearing are no longer the exact same size and the quality of the cut will be affected.

The new *In-Tech* line of router bits from *Amana* solves the problem by making the individual carbide cutters on the bit removable. So when the edge is dull, you simply turn the cutter to a fresh edge or replace it with a new, inexpensive insert.

GOOD SELECTION. A quick scan of the bits in the photo below shows that *Amana* chose nine of the most commonly used profiles for woodworkers. These are the workhorses of most home shops. So the cost savings is significant when averaged over the life of these new bits. Sources on page 51 has the information on where to find them.

A NOT-SO-NEW IDEA. This isn't a new concept in router bit design, however. *Amana* has produced replaceable insert bits for CNC (computer numerically controlled) industrial machines for many years (see box on opposite page). These designs have proven themselves in production environments. But bringing this technology to the home woodworker might change the way you think about router bits.

▼ *Amana's In-Tech* line of router bits includes nine common profiles.



HOW THEY WORK. To make changing cutters possible, the carbide inserts are held in place with a screw. (I really appreciated *Amana* including the proper size hex wrench with each bit.)

At first I was a little nervous about a single screw holding the cutter of a bit moving at 20,000 RPM, but I never found it to be a problem. Aligning the cutter in the bit is made easy by the design of the body — you'd have a hard time installing them incorrectly.

PERFORMANCE. I was curious to see how well these bits perform in normal workshop use, so I gave them a pretty good workout on different materials. I started with the rabbet bit and cut deep rabbets in white oak, plywood, and MDF.

▲ To protect your fingers, it's a good idea to wear a leather glove while rotating or replacing the carbide cutters.

I purposely removed more material than I normally would in a single pass to put some strain on the bits. You can see the results in the photos at right. The cuts were smooth in each of the different materials. I continued the test alternating between plywood, MDF, and oak and ended up routing over 100 linear feet without seeing any degradation in performance.

In fact, I routed just about everything I could get my hands on for a couple of days (including melamine-covered particle board, a notorious bit killer). But the bits showed no sign of slowing down or losing their edge.

On one occasion, however, I did manage to break a cutter. While using a flush-trim bit to level some glued-on edging, the cutter shattered. A glob of dried glue squeeze-out was to blame. And it turns out the carbide used in these bits has something to do with it.

SUB-MICRO GRADE CARBIDE. The unique thing about these bits is that they're made of a harder grade of tungsten carbide than conventional bits. This "sub-micro grade" carbide can't be brazed onto the body of a bit. So these bits are the perfect application for the harder metal. However, the hardness of the carbide also means that the inserts tend to be a little more brittle.

THE PRICE. The most surprising thing about the *In-Tech* bits is the price. Overall, they're comparable to other high-quality bits. For example, the straight plunge bit runs about $17 and a new insert is $4. The price for both bits and inserts goes up as the complexity of the bit's profile increases. The ogee fillet, for instance, is $52 and $16 for the pair of replacement cutters.

BOTTOM LINE. As I said earlier, this technology has been used on CNC router bits for years. So it should be no surprise that the bits performed well in the workshop.

In spite of their unconventional appearance, the *In-Tech* bits ran smooth and were free of vibration. The cutting performance consistently matched or exceeded what you'd expect from a high-quality conventional bit.

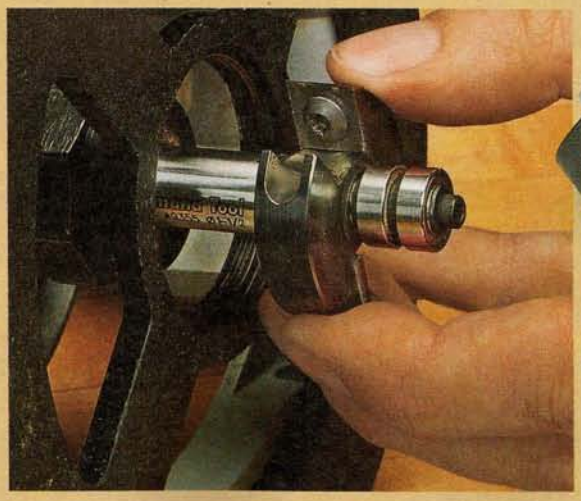
Coupling their performance with the low cost of replacing the insert cutters instead of buying new bits, they're sure to be a welcome addition to any shop. W

▲ The *In-Tech* bits cut smooth edges in plywood (top), MDF (middle), and white oak (bottom).

Stepping Up: Heavy-Duty Bits

After looking over *Amana's* new *In-Tech* bits, you might wonder why they didn't include ½" shanks in the lineup. As it happens, they're already available and in greater numbers than the *In-Tech* line. Dozens of common profiles are in use every day in industrial applications.

The problem is, they're often priced beyond the reach of most woodworkers. For example, the ½" shank rabbet bit shown in the margin photo retails for $110. The smaller *In-Tech* bit below it is only $29. Of course there are advantages beyond just the shank size with the more expensive bit. The carbide inserts are available in different grades, allowing you to tailor the cutter to the specific type of material.



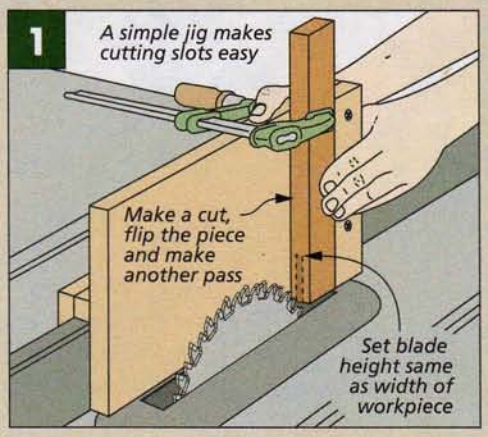
▲ The ½"-shank bits offer the convenience of replaceable inserts but with heavier-duty construction.

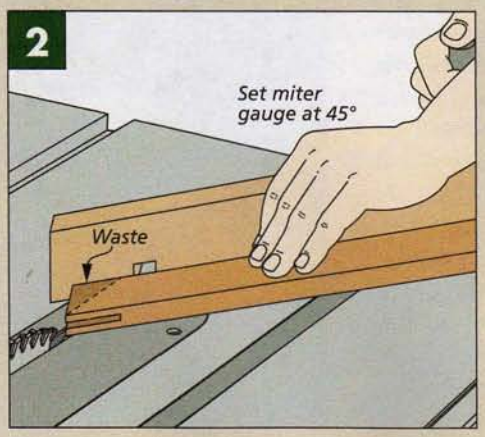
tips for creating a Mitered Bridle Joint

A table saw and a simple, shop-made jig are all you need to make strong, tight-fitting miter joints.

Miter joints look great on a project. But a weakness of miter joints is that they rely on end grain for gluing strength. And end grain joints are pretty weak. There are several ways to strengthen a miter joint. But a traditional method that I like to use is a mitered bridle joint.

A mitered bridle joint is similar to an open mortise and tenon joint. One piece has a through slot and the other a matching tenon. But the shoulders of both pieces are mitered. The benefit of this joint is that it offers plenty of glue surface for a strong joint (main photo).





MAKING THE JOINT

The key to a strong mitered bridle joint is getting a snug fit on the mating parts. For this reason, I like to cut the slot first and then sneak up on the thickness of the tenon. To cut the slots, you'll need a way to support the workpiece on end. You can use either a shop-made or commercial tenoning jig on the table saw (Figure 1). I use a dado blade for ¼" or larger slots. Slots for ⅛"-thick tenons can be cut with a single blade.

DETERMINING SIZE. The thickness of the slot is governed by the thickness of the workpiece. A good guide is to make it one third the thickness of the workpiece. (For example, a ¼" slot for ¾" stock.)

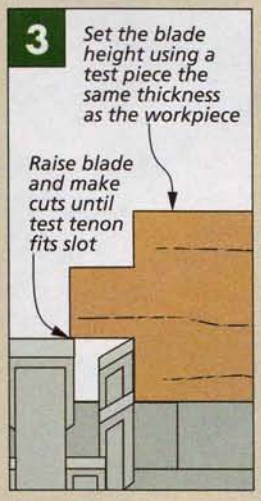
SLOT. To position the workpiece correctly, I set the rip fence so that the distance between the blade

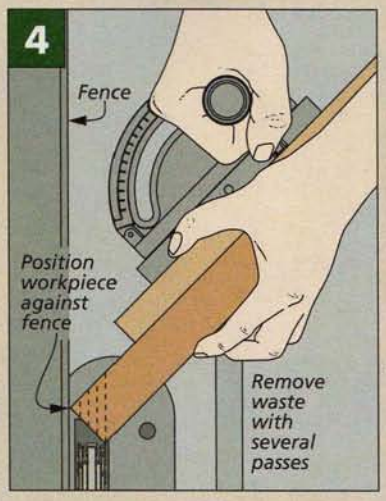
and the jig is one third the thickness of the workpiece. Then you can clamp the workpiece in the tenoning jig and make the first cut. Simply flip the workpiece for the second cut. This will center the slot on the thickness of the workpiece.

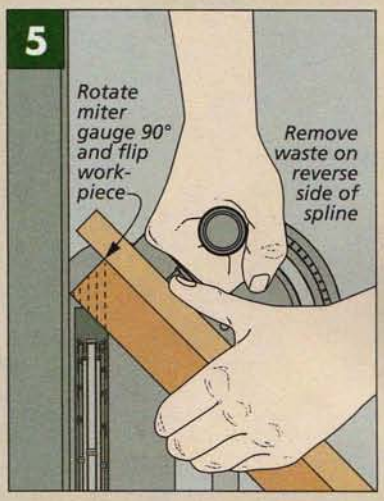
MITER. To mark the mitered ends, you can use a combination square. Then set your miter gauge at 45° and make the cut (Figure 2).

TENONS. Once you have the slots cut, making the tenons on the mating pieces to fit is pretty simple. I've found that the easiest way to cut these is with a dado blade and a miter gauge, laying the workpiece flat on the saw table.

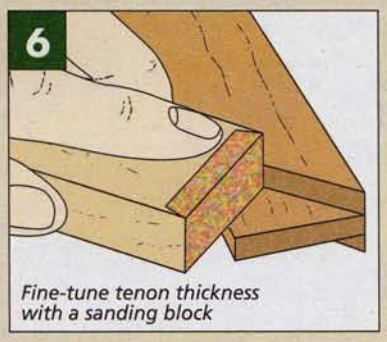
Using the slotted workpiece as a gauge, set the height of the dado blade so it's just below the slot opening. I like to test the blade setting on a scrap piece. This way I can sneak up on the thickness of the tenon by raising the blade a bit until it fits in the slot (Figure 3).







Once you have the blade height set, adjust the miter gauge to 45°, mark a layout line and align it with the saw blade. You can set the rip fence as a stop for the first cut. Then remove the waste with multiple passes, working toward the end until the tenon is shaped on one of the faces (Figure 4). Then flip the workpiece, adjust the miter gauge, and make the same cuts on the opposite face (Figure 5).



Fine-tune tenon thickness with a sanding block

FITTING

Using a dado blade to cut the tenons can leave saw marks. You'll want to smooth the cheeks so the tenons will fit without gaps.

SMOOTHING. A sanding block is a good tool to smooth the cheeks (Figure 6). If the tenon is a little too thick, a shoulder plane or chisel will remove more material. But be careful. It's best to remove small amounts of material from both faces and keep checking until you have a perfect fit that's centered. Once the tenon fits in the slot, you can add the glue.

CLAMPING. Although you can use bar or pipe clamps, I prefer to use a band clamp for assembling mitered joints. This way, all the corners will be pulled together at once for a good fit. Add clamping blocks and additional clamps to apply pressure to each joint (photo at right).

Adding a tenon always makes a stronger joint. But the tenon doesn't have to be in the center, as you can see in the box below.

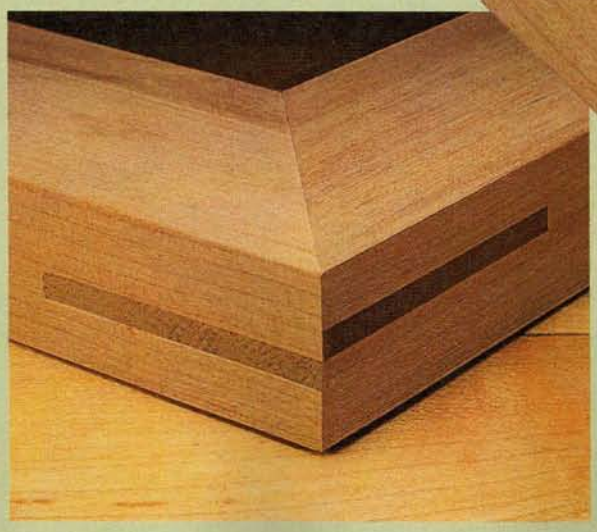
▼ Clamping blocks and a clamp at each joint ensures a tight miter.

Worth A Look: Double Bridle Miter Joint

A variation of the joint shown above is the double bridle miter joint. The first thing you'll notice about this joint is that each piece has a slot and a tenon. This makes the joint a good alternative if you want a similar look along both edges.

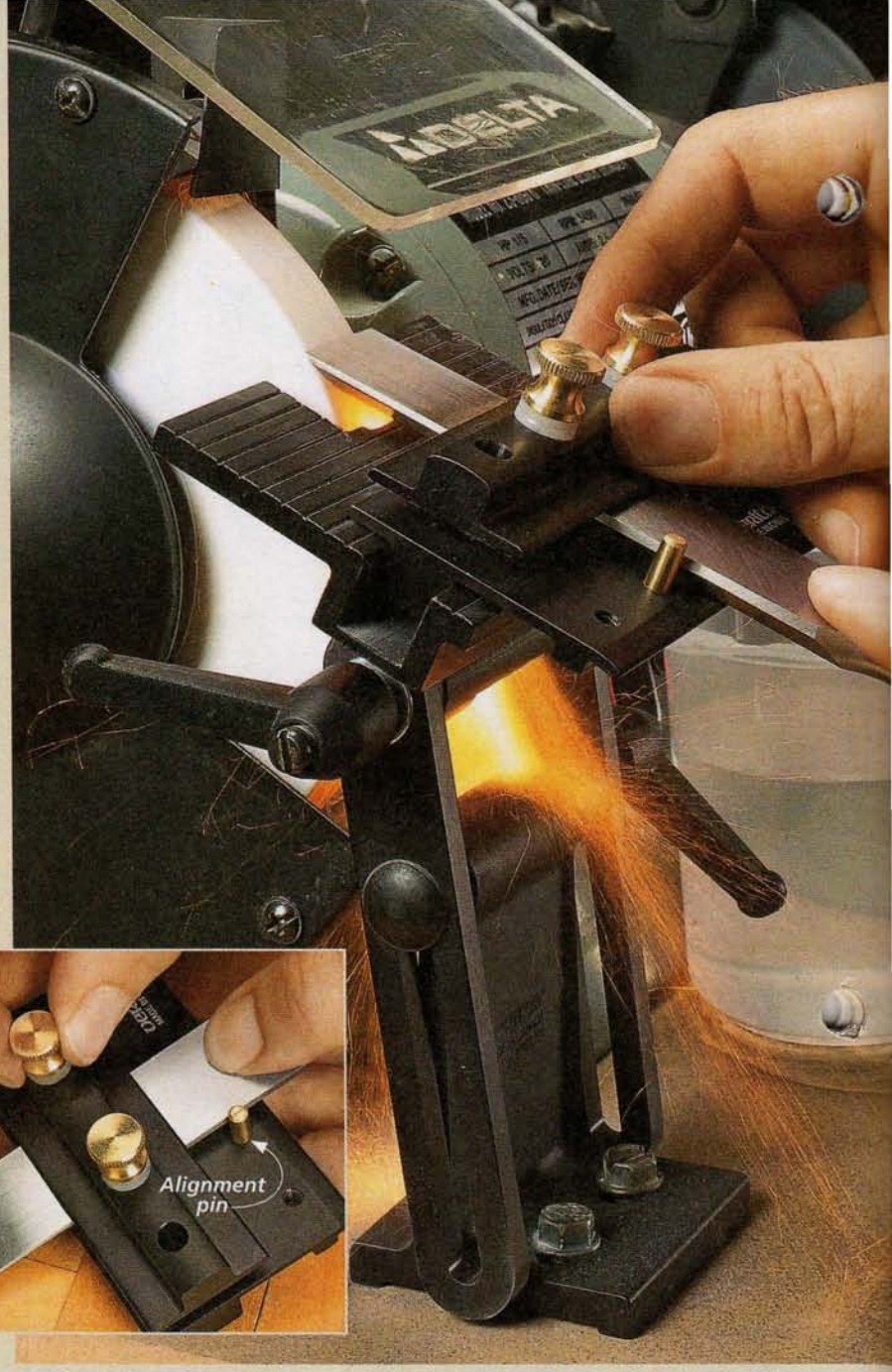
DIFFERENCES. One of the interesting features of this joint is that both halves are identical. When you flip one side of the frame, the offset tenon meets the slot, and the joint goes together (first photo at right). This makes laying out and cutting the joint a little easier.

This type of joint is most commonly used on frames for artist's canvases, but can be used on other types of frames as well.


▲ Each piece is identical and has both a tenon and slot on each end.

bench grinder **Tool Rests**

Add some precision to your sharpening tasks by upgrading your tool rest.



▲ The *Veritas* sharpening jig holds the tool securely. It slides back and forth in the machined groove to provide a consistent, square edge.

A bench grinder is an indispensable tool for maintaining an edge on chisels, turning tools, and plane irons. For many woodworkers, it's the first step in the tool sharpening process. But most bench grinders come with inadequate tool rests that make it difficult or impossible to get consistent results.

Fortunately, there are a few after-market tool rests that can improve your ability to grind tools accurately and safely. I recently tried out a couple of these.

REQUIREMENTS. Before looking at each of the different models, it's worth taking a minute to focus on what's important in a tool rest. First, it needs to provide a stable platform. That is, it should be able to hold the tool firmly at a predetermined angle without excessive vibration. And this is where most of the stock rests fall short. They're often undersized and made of thin steel, held in position with a wing nut.

The second important feature to look for in a tool rest is easy adjustability. You need to be able to set the correct grinding angle for a variety of different tools. And once the angle is established, the rest needs a reliable, solid mechanism to lock in that angle.

Finally, since your grinding tasks might include everything from a large turning gouge to a small spokeshave blade, having a versatile tool holder to make the task easier and safer is a big plus.

▼ The *Veritas Grinding Set* makes grinding accurate bevels on chisels and plane irons a simple task.

THE VERITAS GRINDING SET

The first tool rest I looked at was the *Veritas Basic Grinding Set*. As the name implies, this is more than just a tool rest. It's a complete sharpening system with a grinding jig and an angle-setting gauge.

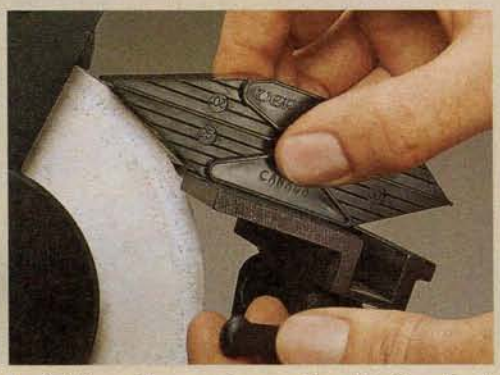
SETTING UP. At the heart of the system is the anodized aluminum tool rest that mounts to a board along with your grinder. The rest features a large platform that includes a slot for the grinding jig. The main photo above shows the tool rest and jig in action. Position adjustments are made easy with the two

spring-loaded handles that allow you to move the platform to just about any grinding angle.

THE ANGLE-SETTING GAUGE. Zeroing in on a specific angle can be a hassle in any sharpening setup, but the plastic gauge included with the *Veritas* set makes it a breeze. The gauge includes the most commonly used bevel angles of 20°, 25°, 30°, and 35°. While holding the gauge against the wheel, you simply lock the platform to the matching angle, as shown in the photo below.

THE GRINDING JIG. With the tool rest locked in place, the next step is to mount your tool in the grinding jig. A pair of thumbscrews tightens down a clamping bar, securely holding the tool in place. A brass pin registers the blade at 90° for most common tasks. The main photo and inset on the opposite page show this pin. To sharpen skew chisels, simply move the pin to change the angle to 30°.

Overall, the *Veritas* jig provides a solid and easy-to-use grinding system for a very reasonable price ($69). For sources on where you can purchase the *Veritas* system, take a look at page 51.

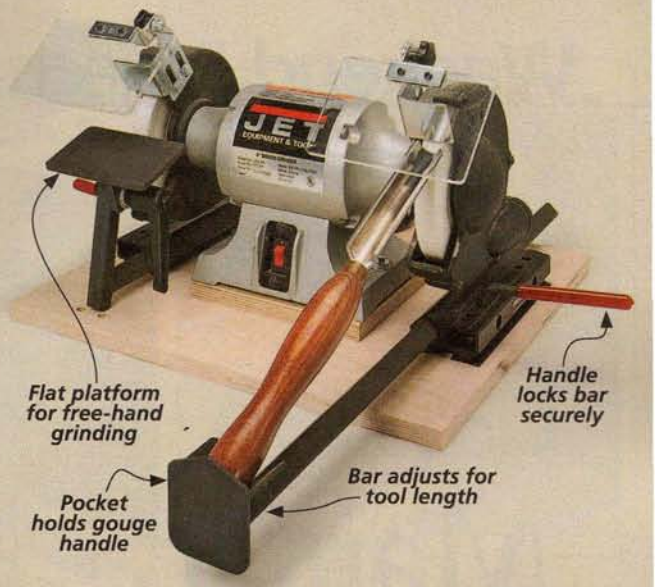


▲ Setting the angle on the *Veritas* tool rest is a breeze. Just align the correct face of the angle gauge to the wheel.

WOLVERINE

The second tool rest I tried was the *Wolverine* from *Oneway*. Since *Oneway* makes some of the finest lathes on the market, it's no surprise that this tool rest is geared toward sharpening turning tools.

CONSTRUCTION. The photo above shows how the *Wolverine* works. A base mounted beneath each grinding wheel supports a ¾"-square steel tube arm. The adjustable arms hold a tool rest on one wheel and a unique design for sharpening longer tools on the other. The square tube arms slide in well-machined channels on the base and lock in place with oversized handles. For ease of use and holding power, these locks just can't be beat. And the all-steel construction ensures a lifetime of reliable service.



▲ *Wolverine's* adjustable arm allows you to grind a perfect bevel on round gouges.

A STABLE PLATFORM. The *Wolverine's* tool rest takes full advantage of the steel construction by providing a rock-solid surface. This platform is for grinding chisels and other flat beveled tools. It's great for free-hand grinding, but jigs are available to hold chisels and plane irons as well. Or you could easily build a couple of shop-made jigs for your other tools.

A DIFFERENT APPROACH. But the *Wolverine* really shines at sharpening turning tools. For example, rather than trying to set a platform to the proper grinding angle for a roughing gouge, the *Wolverine* handles the task with a pocket on the sliding arm to hold the end of the tool.

By sliding the arm toward or away from the wheel, you can set the grinding angle to match the gouge's bevel. Once in place, you just rotate the gouge against the wheel to sharpen it across the full face of the cutting edge.

This is a great method for grinding and maintaining consistent bevels. And since turning tools need very frequent touch-up sharpening, this design is a winner.

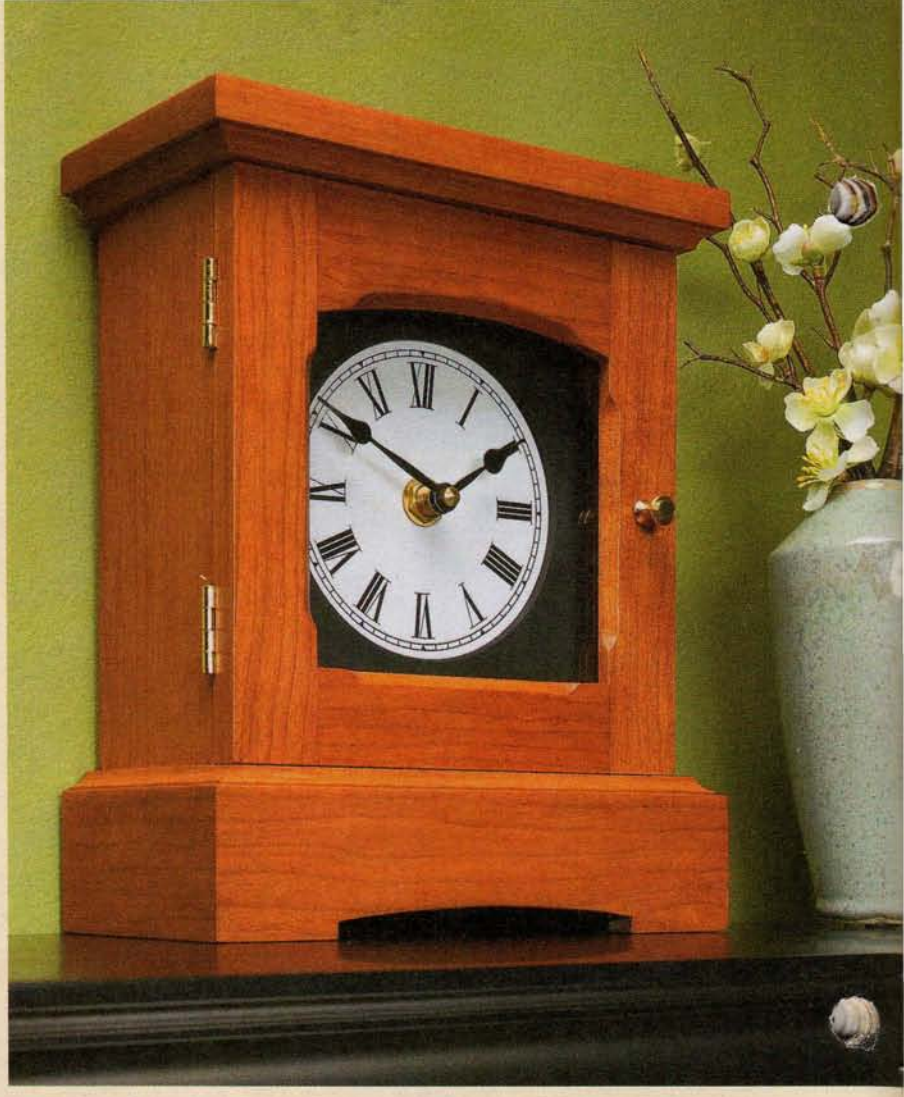
BOTTOM LINE. All in all, you can't go wrong with either of these well-made systems. Which one is right for you depends on the kind of woodworking you do.

Replacement Grinding Wheels

To get the most out of your bench grinder as a tool sharpening system, you'll probably want to replace the wheel. Most grinders are sold with a gray, all-purpose wheel that's not well-suited for grinding tool steel.

The white, aluminum-oxide wheel in the photo at right will help you get better results. This wheel has a softer bonding agent holding the abrasive particles. The soft bond allows the abrasives to break away as they lose their cutting edge. This exposes fresh abrasives and prevents the wheel from loading up with metal filings, keeping it running cooler and making it less likely to burn your tools. See Sources on page 51 to find out where to buy these replacement wheels.

classic Mantel Clock



This is a chance to give your skills a workout and use a few of those leftover pieces of wood you've been hanging on to.

The art of making clocks was once limited to a very small group of highly specialized artisans. Cutting and assembling intricate gears and movements from exotic woods and metals was an activity left to only the most experienced craftsmen.

Fortunately, woodworkers today have some significant advantages. With the click of a mouse we can order clockworks, hands, and faces in dozens of different styles.

The clock shown above is an excellent example. Its inexpensive quartz movement is far more accurate than most of its antique predecessors and far easier to install. Sources on page 51 has the details on where to find a movement you like and all the supplies you'll need to get started on your clock.

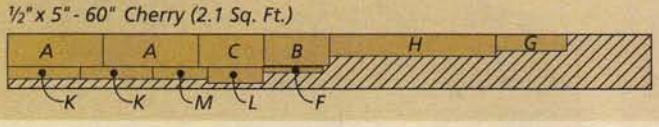
But the best thing about making a clock is that it gives you a chance to work on small details. I find that this type of project is a great way to hone your woodworking skills.

For instance, the shop-made, mitered molding at the bottom and the elegant chamfered curve on the door's top rail give you a great opportunity to work on the skills you'll often use on larger projects. And by perfecting your attention to detail on a smaller piece, you'll be able to tackle larger projects with confidence.

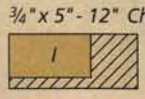
Materials, Supplies & Cutting Diagram

A Case Sides (2)	1/2 x 3 - 8 7/8	**I** Cap (1)	3/4 x 4 - 7 5/8
B Case Top (1)	1/2 x 2 7/8 - 6 1/8	**J** Clock Face Trim (1)	1/8 hdbd. - 6 1/8 x 5 5/8
C Case Bottom (1)	1/2 x 3 - 6 1/8	**K** Door Stiles (2)	1/2 x 1 1/8 - 6 3/4
D Mount Board (1)	1/8 hdbd. - 6 1/8 x 6 5/8	**L** Door Top Rail (1)	1/2 x 1 1/2 - 5 1/8
E Back Panel (1)	1/8 hdbd. - 6 1/8 x 6 5/8	**M** Door Bottom Rail (1)	1/2 x 1 1/8 - 5 1/8
F Back Panel Cleat (1)	1/2 x 1/2 - 5 5/8	• (1) 1/8" x 5"- 5" Glass	• (1) 4 1/8 "-dia. Clock Face
G Base Trim Backer (1)	1/2 x 1 1/2 - 6 5/8	• (1) Clock Movement	• (1 pr.) 1" x 3/4" Brass Hinges w/Screws
H Base Trim (1)	1/2 x 2 - 18 rgh.	• (1 pr.) 1 7/8 " Clock Hands	• (1) 3/8 "-dia. Brass Knob
			• (1) 1/4 "-dia. Rare-Earth Magnet
			• (1) #4 x 3/8 " Fh Woodscrew
			• (2) Brass Turnbuttons
			• (2) #6 x 5/8 " Fh Brass Screws

1/2" x 5" - 60" Cherry (2.1 Sq. Ft.)



3/4" x 5" - 12" Cherry (0.5 Bd. Ft.)



Also needed: One 12" x 24" sheet of 1/8" hardboard

building the CASE

A simple case houses the clockwork and components. And building the case is pretty straightforward. Dadoes and rabbets in the sides hold the top and bottom, while a saw kerf secures the clock mount board. Finally, a rabbet on the back edge holds the back panel.

THE SIDES. The sides contain most of the joinery cuts for this case, so that's the place to start. After cutting both sides to final size, I labeled them 'right' and 'left' and marked the location of the joinery cuts. The goal is to make them mirror images of each other. The layout marks and labels help avoid mistakes while making the cuts.

You can start with a dado blade in the table saw to cut the dado for the bottom. Next, attach an auxiliary rip fence and cut the rabbets on both pieces. Detail 'c' and the box below will give you more information.

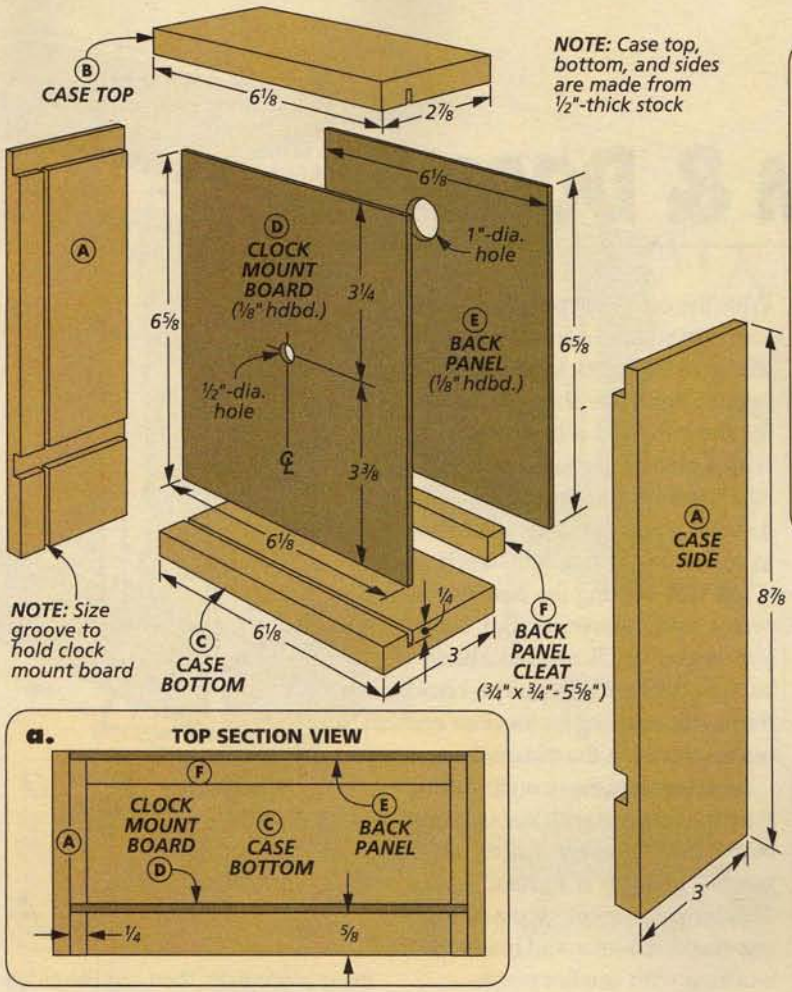
Now you're ready to cut the grooves for the clock mount board. Detail 'a' shows the placement and depth for this cut. A standard (1/8") blade is all you need.

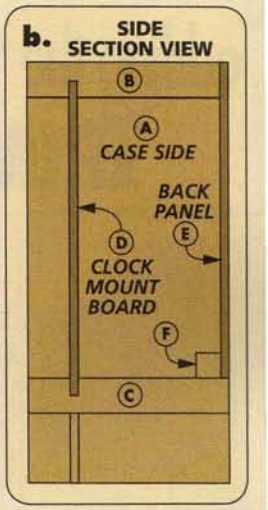
TOP & BOTTOM. With the sides complete, you can move on to the top and bottom. Note that the top is slightly narrower than the bottom and sides (detail 'b'). All you need to do to these pieces is cut a kerf to hold the clock mount board.

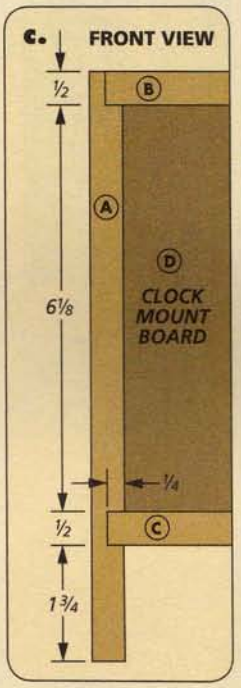
CLOCK MOUNT BOARD & BACK PANEL. The clock movement attaches to a piece of 1/8"-thick hardboard that fits into the kerfs you cut earlier. You'll need to drill a hole for the movement as shown in the illustration.

The back panel is held in the rabbet with brass turnbuttons you'll add later. For now, just cut it to size and drill the fingerhole as shown above. Then attach the hardwood cleat to the case bottom with glue.

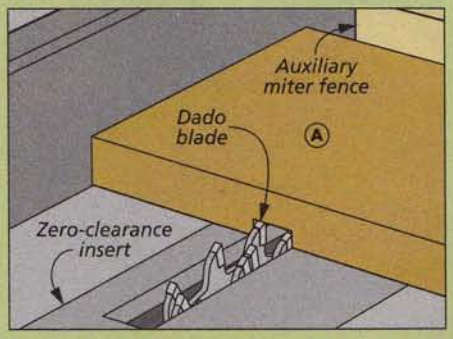
ASSEMBLY. The dadoes and rabbets make the assembly a breeze. And the clock mount board helps keep everything square. All you need to do is add glue to the joints and clamp the assembly. Next, you're ready to work on the molding.



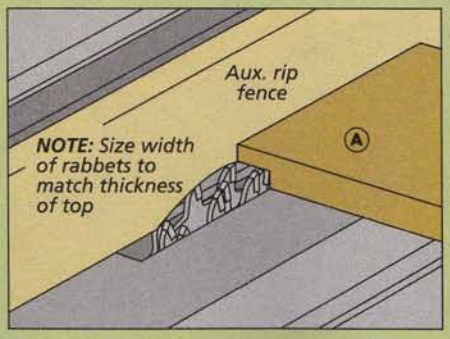




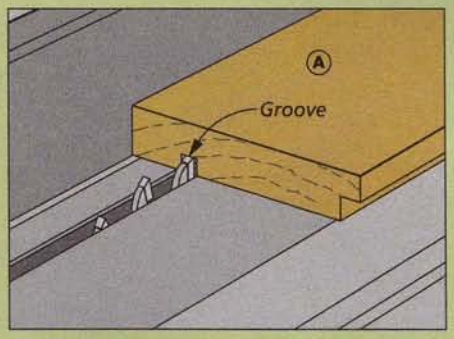
How-To: Dadoes, Rabbets, and Kerfs



Dadoes. *Set the dado blade to match the thickness of the bottom and use a zero-clearance insert to minimize tearout.*

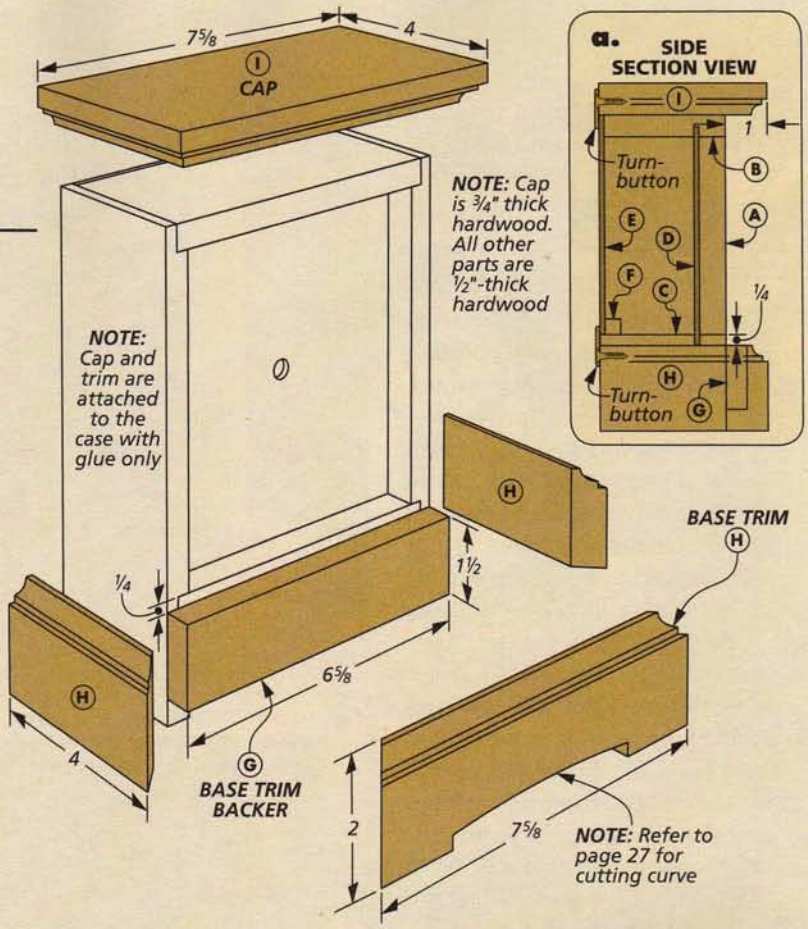


Cutting Rabbets. *Attach an auxiliary fence to the rip fence of your saw and expose a portion of the blade to cut the rabbet.*



Add a Groove. *A standard rip blade cuts a perfect groove for the 1/8"-thick hardboard clock mount board.*

adding the TRIM & DOOR



With the case assembled, the next step is to add the decorative details that give this clock its classic look. I chose a simple, shop-made trim for the base and a hardwood cap with a matching routed profile. To add depth to the clock face, I also installed a painted hardboard panel to surround the face and hands.

BASE TRIM. Making the base trim is pretty straightforward. But before you begin, you'll need to attach a backer board to the front. This board frames the opening for the door and makes attaching the trim easier.

Now you can move on to cutting the trim. I started with an oversized blank (long enough for all three pieces), and cut it to final width. This longer workpiece made routing the profile safer and easier than working with smaller pieces.

At the router table, I used a classical cove bit to rout the profile. The left drawing below shows how I did this using a featherboard for a more consistent cut.

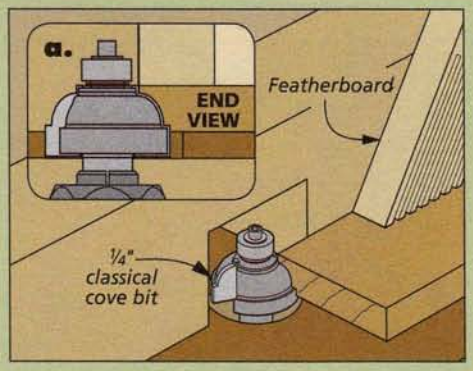
MITERS. After you're done at the router table, you're ready to cut the miters. For these cuts, I turned to the table saw and a miter gauge as shown in the right drawing below. I find it works best to fit the front piece first, then cut the sides to fit. This way, you can focus on getting a tight miter. Then just cut the back ends to length, flush with the back edge of the case.

FRONT CUTOUT. The front base trim piece also has a decorative cutout. I waited until after completing the miters to make this cut so I could keep it centered on the workpiece. You can find tips for making this cut in Shop Notebook on page 26.

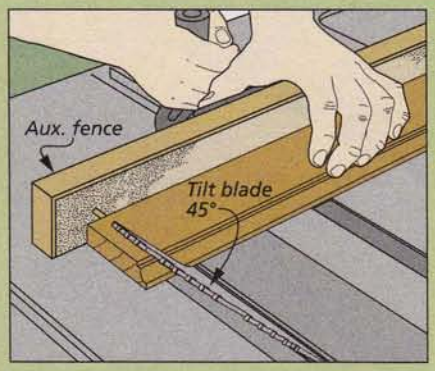
ATTACH THE TRIM. Now it's just a matter of attaching the trim with glue and clamps. Make sure to put glue on the ends of the miters, as well, before adding clamps.

THE CAP. The cap is made from ¾"-thick stock. After cutting it to final size, I headed back to the router table. Using the same setup as you did for the base, rout the matching profile on the front and side edges of the top. Then, glue it in place.

How-To: Make the Trim



Routing the Cove Profile. *A featherboard holds the workpiece flat against the router table for a smooth, consistent cut.*



Cutting Miters. *Use an auxiliary fence on the miter gauge to back up the cut and prevent tearing out the ends.*

▲ Clamp the workpiece to the drill press table and use a wing cutter to cut out the circle in the clock face trim board.

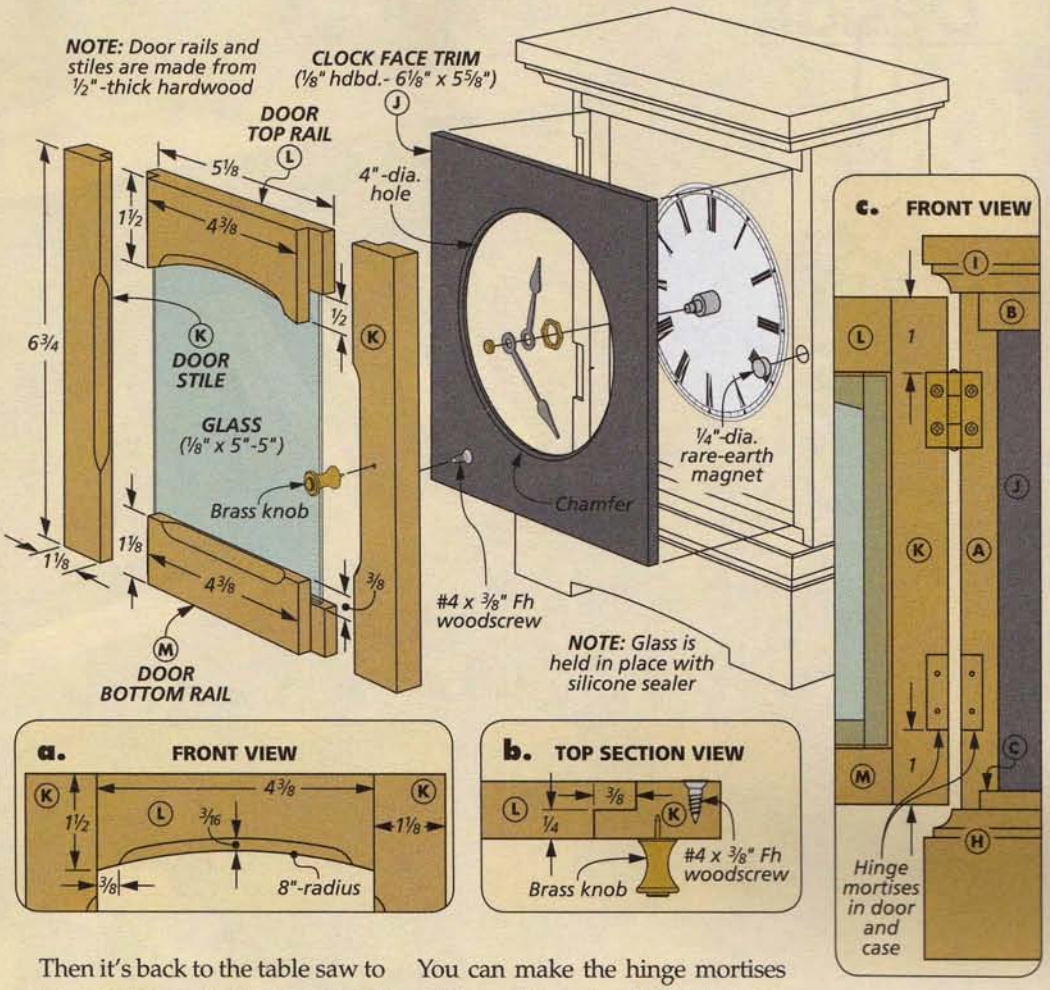
CLOCK FACE TRIM. To create a frame around the clock face, I cut a hardboard panel to fit the case opening. Then I cut out a circle slightly smaller in diameter than the face (photo on the opposite page). The trick to cutting this circle is to tape two pieces together. This way, you'll have enough thickness for the bearing of a router bit to ride against when you rout the chamfer. After chamfering the circle, I finished the piece by painting it black. You can set it aside until after installing the clock movement and hands.

THE DOOR

A simple frame and glass panel door protects the clock face and hands. It also adds to the traditional look of the clock. Half-lap joinery makes it a snap to build.

RAILS & STILES. You can begin by cutting the rails and stiles to final size (note the wider top rail). You'll notice that the top rail has a gentle curve on the lower edge (detail 'a'). I used a band saw to make this cut (left drawing below).

CHAMFER THE EDGES. The stopped chamfer on the inside edges of the rails and stiles provides an interesting detail. To chamfer the curved and straight edges, all you need to do is mark start and stop points on the workpieces. Then just rout to the layout line as shown in the center drawing below.

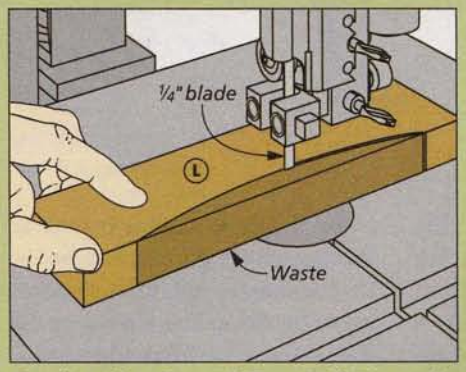


Then it's back to the table saw to cut the rabbet on the inside edge of all four pieces (detail 'b'). The rabbet on the top rail is ½" wide, but the others are all ⅜". Next, you can cut the rabbets for the half laps on both rails. Assemble the door and install the glass panel using a small bead of silicone sealer.

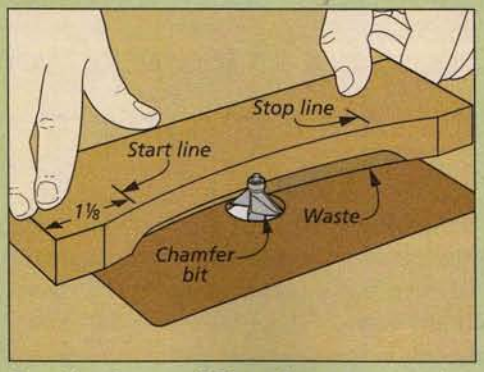
PUTTING IT ALL TOGETHER. Final assembly begins by installing the door. You can make the hinge mortises with a palm router (right drawing below). Then, drill a hole for a rare-earth magnet and glue it in place with epoxy. Now install the door pull and a screw for the magnet.

After applying a finish to the body of the clock, add the movement, hands, and face. Finally, attach the face trim using just a dab of glue to avoid squeezeout.

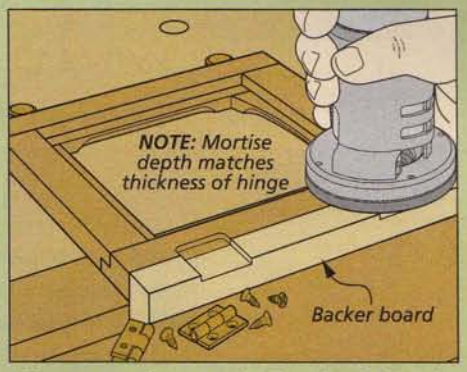
Complete the Door



Cutting the Curved Top Rail. *Keep the blade on the outside of the layout line when cutting the curve. Then sand to the line.*



Routing Stopped Chamfers. *Accurate layout marks on the rails and stiles make routing the stopped chamfer a snap.*



Hinge Mortises. *A backer board in the vise helps hold the palm router level while routing the hinge mortises.*

trough-style Bookrack

This stylish bookrack can be at home in any room of the house. But it's the woodworking challenges that make it a great project.

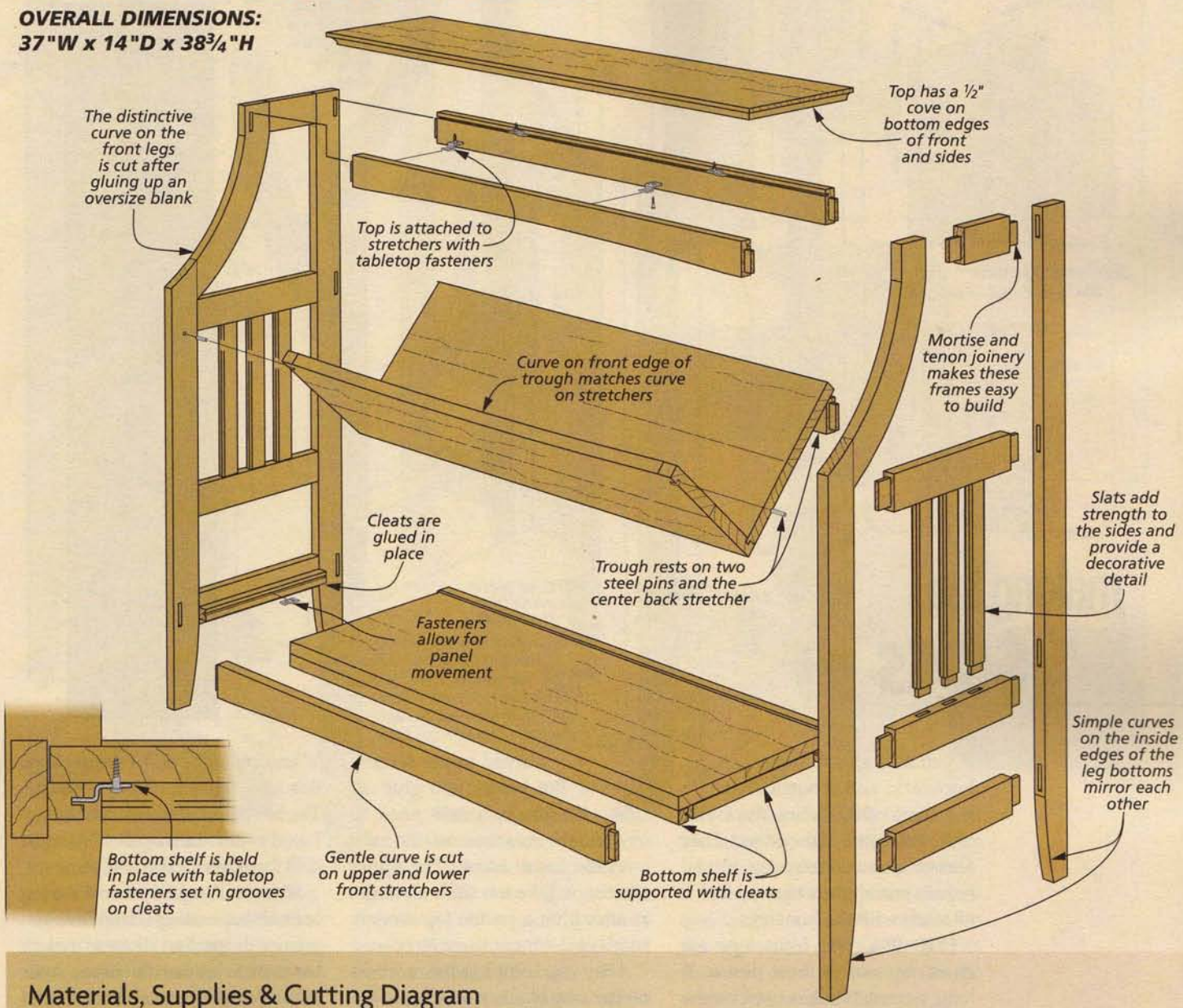
A sturdy bookrack with shelves above and below offers convenient storage when placed in a hallway or just about any room. And this bookrack not only helps out with your storage needs, but provides an attractive accent piece to the room as well.

But for a woodworker, the greatest thing about this bookrack is building it. The curved front legs that give the piece such a unique profile also feature mortise and tenon joinery on both the faces and edges to hold the rails on the sides and the stretchers.

But the most notable feature is the trough-style shelf that holds the books at an angle for easy viewing of the titles. This shelf rests on steel pins at the front edge and a stretcher at the back. I chose to use oak, but this bookrack will look great in just about any wood.

CONSTRUCTION DETAILS

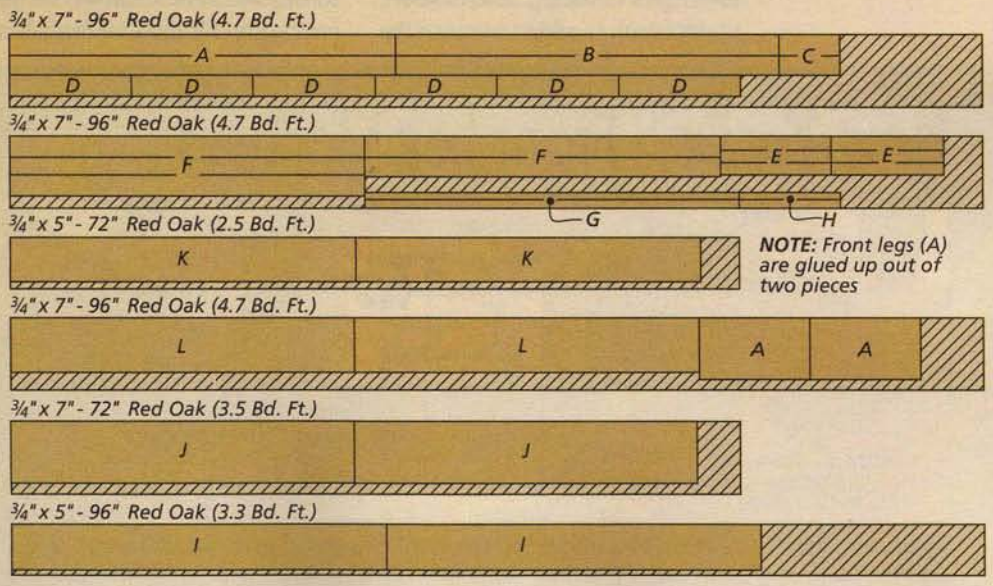
OVERALL DIMENSIONS:
37"W x 14"D x 38¾"H

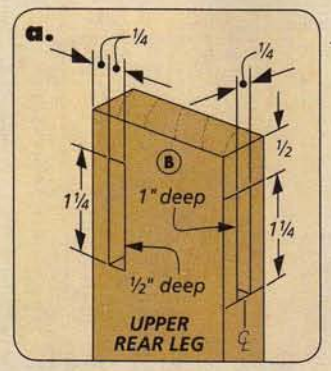


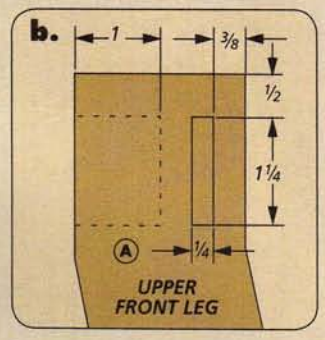
Materials, Supplies & Cutting Diagram

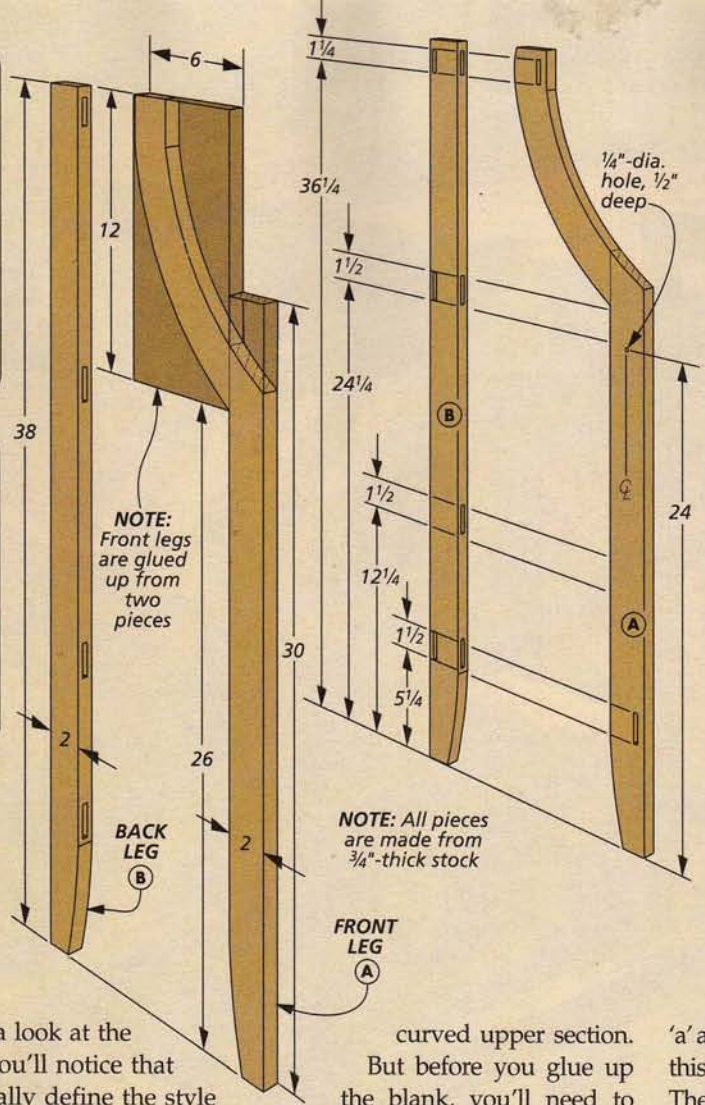
A	Front Legs (2)	¾ x 8 - 38
B	Back Legs (2)	¾ x 2 - 38
C	Top Side Rail (2)	¾ x 2 - 6
D	Side Rails (6)	¾ x 2 - 12
E	Slats (6)	½ x 1¼ - 11
F	Stretchers (5)	¾ x 2 - 35
G	Long Shelf Cleats (2)	¾ x ¾ - 34
H	Short Shelf Cleats (2)	¾ x ¾ - 10
I	Top (1)	¾ x 8¾ - 37
J	Bottom Shelf (1)	¾ x 12¼ - 33⅞
K	Trough Front (1)	¾ x 8½ - 34
L	Trough Back (1)	¾ x 10¼ - 34

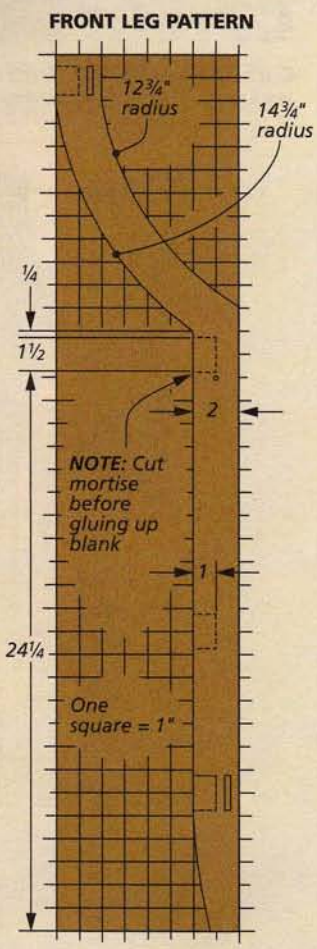
- (10) Tabletop Fasteners
- (10) #8 x ⅝" Ph Woodscrews
- (2) ¼"-dia. x 1" Steel Pins











making the SIDES

If you take a look at the bookrack, you'll notice that the sides really define the style and overall look of the project. They feature a curved front leg, slatted panels, and slightly tapered feet. It all starts with the front legs.

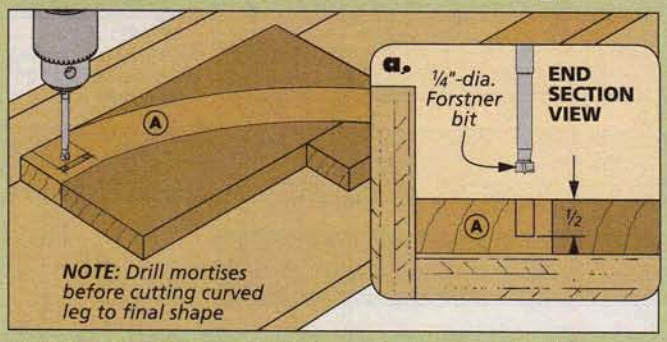
FRONT LEGS. The front legs are glued up out of two pieces. A long, narrow blank is used for the lower part of the leg. Then a short, wider blank is added to make the curved upper section.

But before you glue up the blank, you'll need to cut the mortises for the rails on the lower blank. The upper mortise will be too difficult to get at after gluing on the top section, so it's easier to cut them all now.

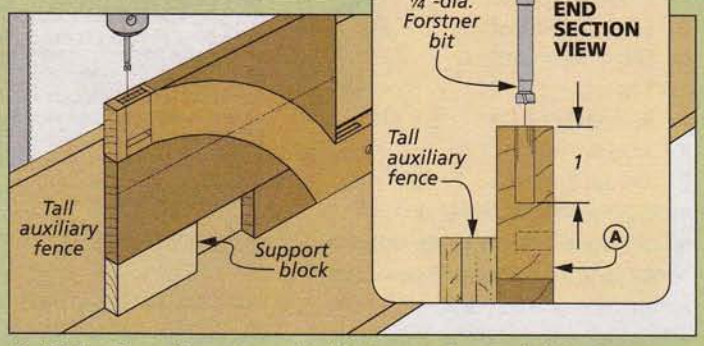
After you complete the mortises on the long blank, you can glue up the top section and cut the mortises for the top rail and stretcher (details 'a' and 'b'). You'll find it's easier to do this now, while the stock is square. The box below shows the technique I used to drill the mortises. Then just drill the holes for the steel pins.

Now you're ready to cut the leg to final shape using a band saw. You can use the pattern above to make a template to lay out the curves. After cutting the leg, I used a router and a pattern bit to trim the legs flush with the template.

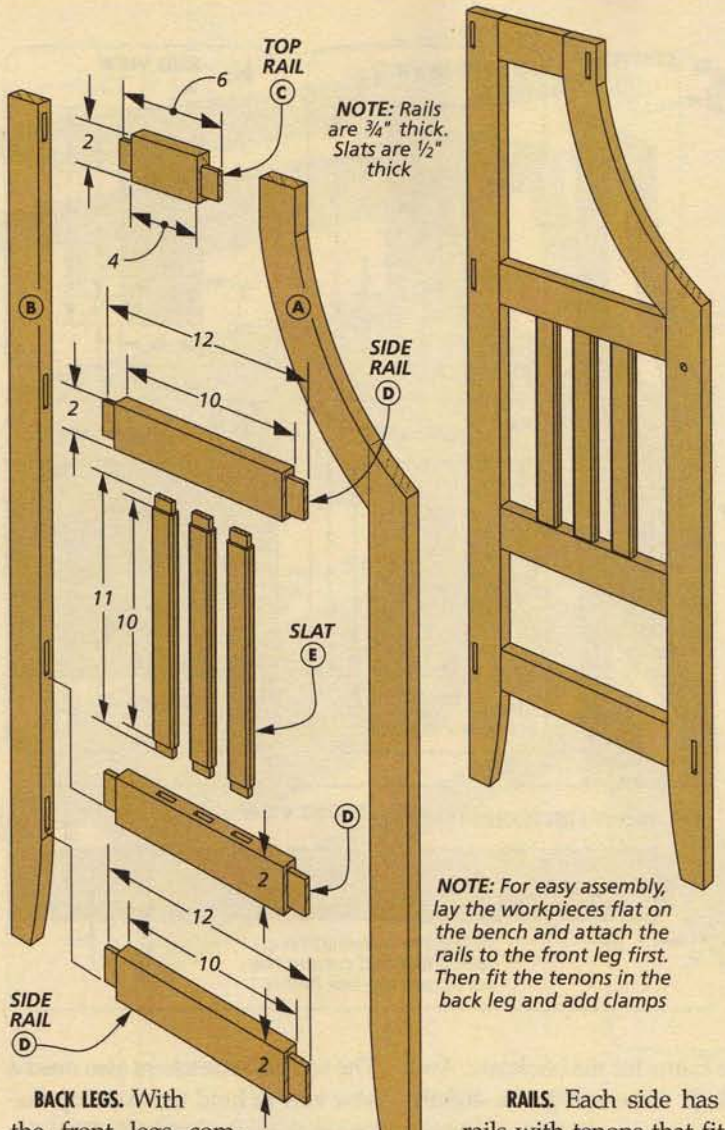
How-To: Drill Front Leg Mortises

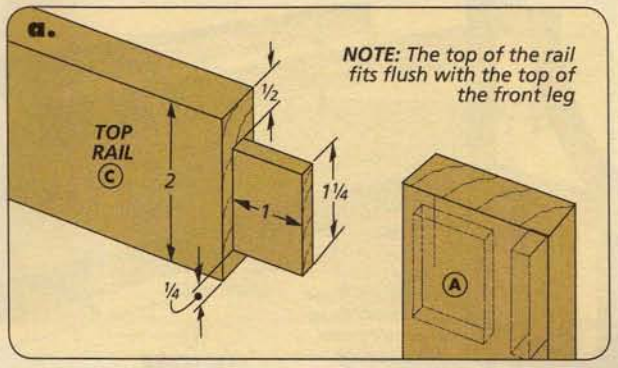


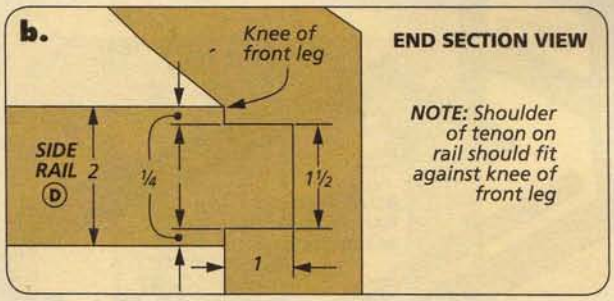
Stretcher Mortises. *With the glued-up blank still square, attach a fence to the drill press to ensure consistent placement of the mortises on the inside face of the leg.*

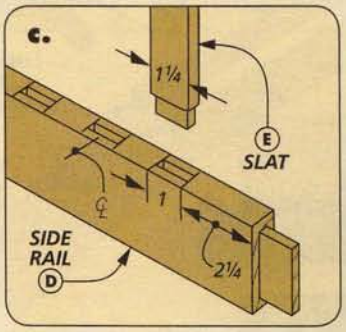


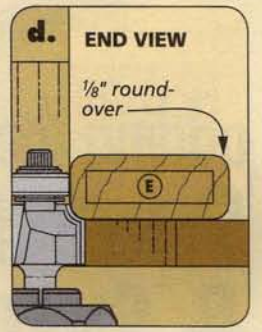
Rail Mortises. *Next, turn the blank on edge and place a support block under the glued-on attachment. A tall, auxiliary fence on the drill press helps hold the piece steady while you drill the mortise.*











NOTE: *For easy assembly, lay the workpieces flat on the bench and attach the rails to the front leg first. Then fit the tenons in the back leg and add clamps*

BACK LEGS. With the front legs complete, the straight, back legs are a breeze. Begin by cutting them to final size, then cut the mortises to match the front legs using the same technique as before. Finally, cut the curved taper at the bottom of the legs at the band saw and sand them smooth.

RAILS. Each side has four rails with tenons that fit into the mortises on the legs. As you can see in the drawing above, the three lower rails are all the same size. The two center rails also need mortises to hold the slats.

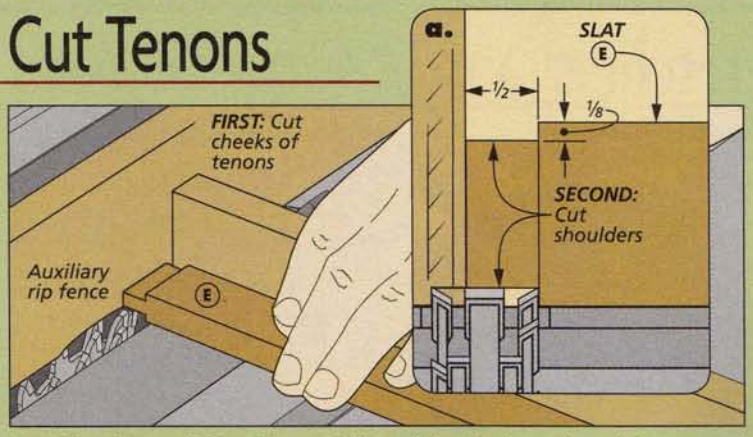
I found it best to cut all the rails to size, and then cut all the tenons on the ends (detail 'a'). This way, you can dry fit each side to make sure the assembly will fit together properly and that the joints are square.

When you've completed the tenons, lay out and cut the mortises in the two center rails for the slats as shown in detail 'c.' You can use the same technique as before.

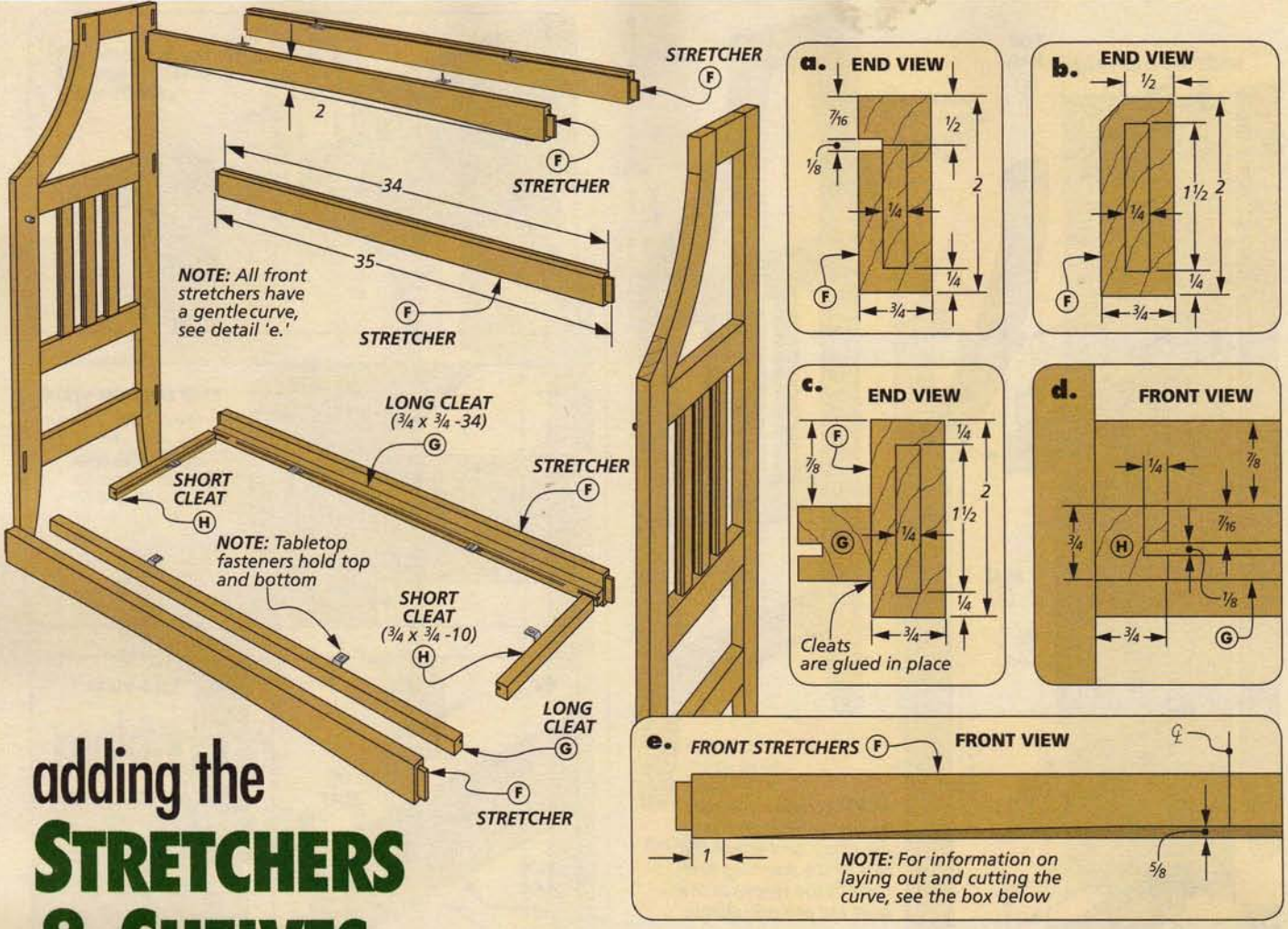
SLATS. Three thin slats fit between each of the center rails. They're made from ½"-thick stock and have a ½"-long tenon on each end. After cutting them all to final size, simply cut the short tenons at the table saw. Then you can round over the edges of the slats at the router table (detail 'd').

ASSEMBLY. The first step in assembling the sides is to glue up the slats and the center rails. Then, glue the rails and assembled slatted panel into the front leg first. Finally, fit the back leg on the tenons, using a clamp at each joint for a tight assembly. With the sides complete, you're ready to move on to adding the trough and shelves. Just turn the page to get started.

Cut Tenons



Cut Cheeks and Shoulders. *With a dado blade on the table saw and an auxiliary rip fence in place to limit the length of cut, simply set the bit height and cut the cheeks and shoulders to form the tenon.*



adding the STRETCHERS & SHELVES

With the sides complete, you're ready to move on to completing the bookrack. You'll start with stretchers that span the sides, then add a top and bottom shelf. Finally, you'll assemble and fit a trough-style bookshelf.

STRETCHERS. Three stretchers on the back and two on the front connect the sides and provide a stable frame for the bookcase. And although each will get a slightly different treatment, you can begin by cutting them all to final size.

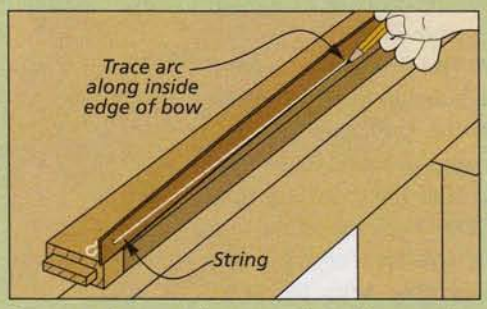
The next step is to move to the table saw and cut tenons on the stretchers. At this point, it's a good idea to label them and mark the individual layouts for each one.

The front stretchers will each need a gentle curve. The box below shows an easy way to cut this curve. The top two stretchers also need a saw kerf to hold the tabletop fasteners that attach the top. This is a simple cut using a standard blade on the table saw (detail 'a').

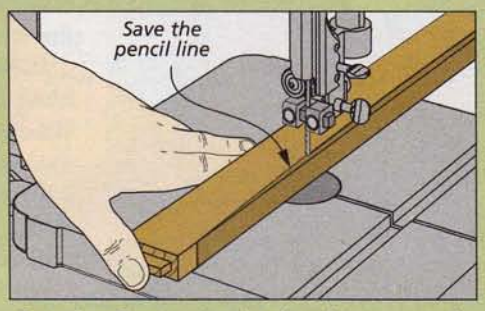
The center back stretcher has a chamfered edge to support the trough. You can cut this chamfer at the table saw by tilting the blade to 45° and cutting off the corner.

ASSEMBLE THE FRAME. With the stretchers complete, it's time to assemble

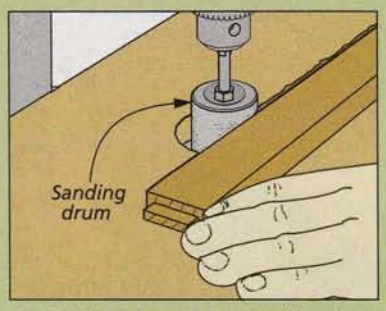
How-To: Cut the Curved Stretchers



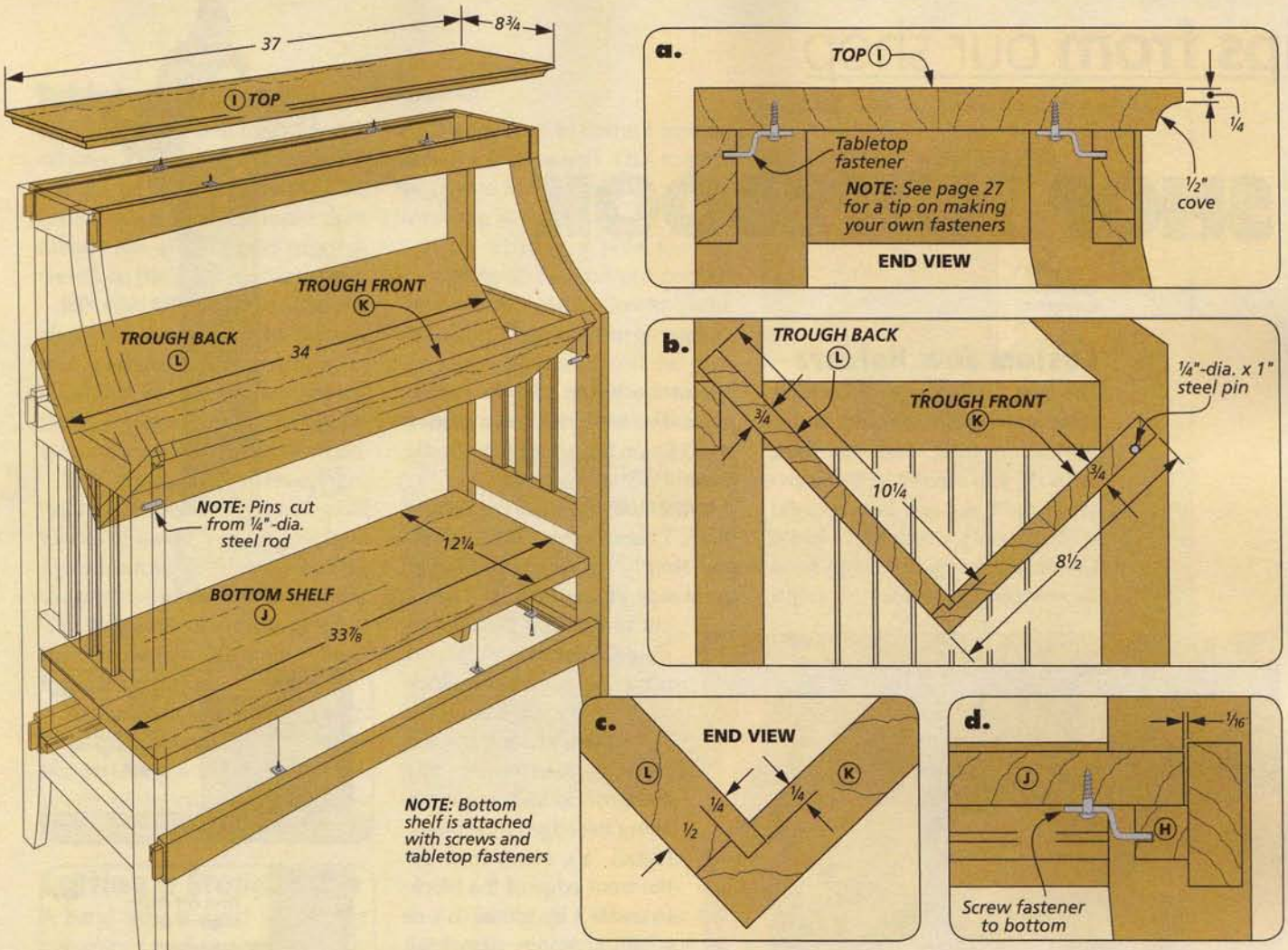
Layout. *Lay out the curve by using a string and a thin strip of hardboard to form a bow. Then draw the gently curved line.*



Cut the Curve. *At the band saw, cut the curve. Keep the blade slightly outside (on the waste side) of the layout line.*



Sand the Edge. *Use a sanding drum on a drill press or a spindle sander to smooth the curved edge.*



the bookcase frame. A little glue on the tenons and in the mortises is all you need before clamping it up.

TOP. Now that you have a stable frame, you can cut the top to final size. Then it's back to the router table to add the cove profile on the ends and front edge. After completing the top, simply attach it to the frame using tabletop fasteners in the grooves on the stretchers (detail 'a,' above).

BOTTOM SHELF. The bottom shelf couldn't be easier. You just cut it to size to fit between the lower rails and stretchers leaving a 1/16" shadow line, as shown in detail 'd.'

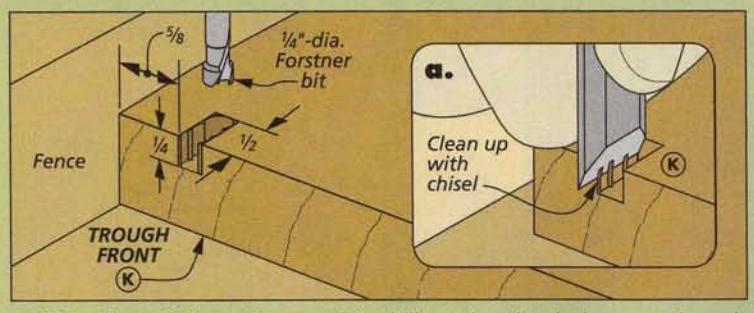
The shelf rests on cleats that are glued to the inside faces of the lower rails and stretchers (details 'c' and 'd' on the opposite page). Grooves in the cleats hold the tabletop fasteners used to attach the shelf. After cutting the cleats and the groove, just glue them in place. Now you can turn your attention to the trough bookshelf.

MAKING THE TROUGH. The trough shelf consists of two parts: a front and back that are assembled using a tongue and groove joint. I used this joint because it provides plenty of glue surface for a strong assembly.

After cutting the two pieces to final size, install a ¼"-wide dado blade on the table saw. Start by cutting the groove in the front piece using the measurements in detail 'c.' Then cut a rabbet in the back piece to form the matching tongue. After cutting the notches for the steel pins, as shown in the drawing at left, you can glue the two pieces together.

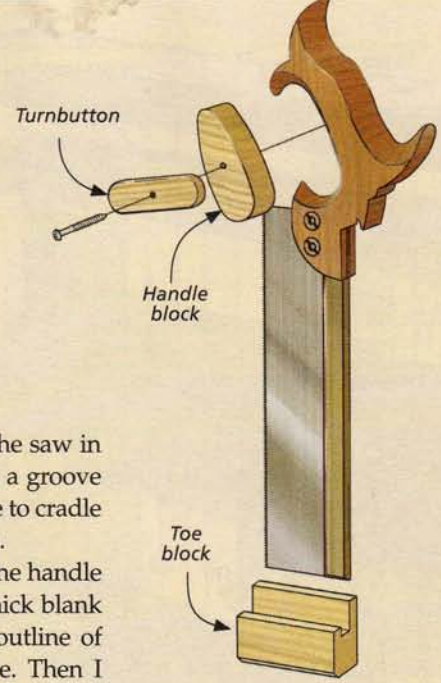
FINAL DETAILS. With steel pins in the front legs, you can fit the trough in position, resting against the back stretcher. Now all that remains is to give the entire piece a final sanding and add a finish. W

Make a Stopped Groove



Drill & Chop. *Using a Forstner bit, drill overlapping holes at each end of the trough front to form the notches for the steel pins. Then clean up the ridges in the sides with paring cuts, using a sharp chisel.*

SHOP NOTEBOOK

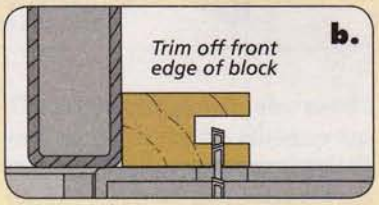


Custom Saw Holders

The saw till on page 38 features some custom-fitted holders for storing dovetail saws and back saws. As you can see in the drawing at right, the saw is supported at each end by a couple of blocks. The handle block is custom fit to the saw handle and features a simple turnbutton to hold the saw in place. The toe block has a groove and a lip on the top edge to cradle the end of the saw blade.

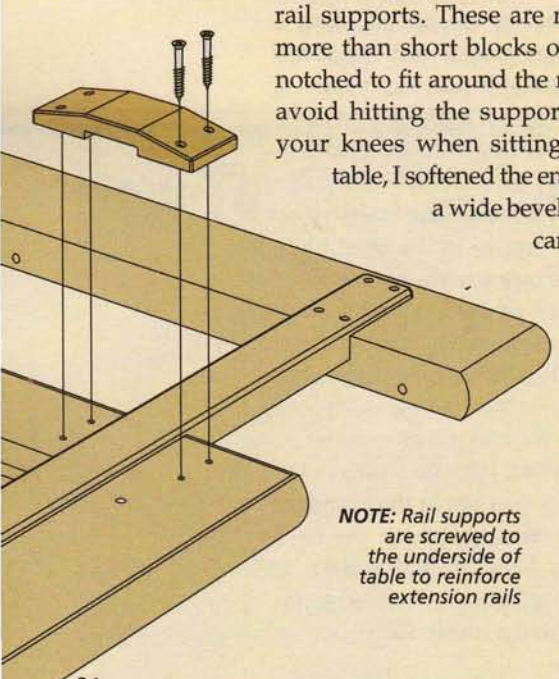
HANDLE BLOCK. To make the handle block, I glued up a 1"-thick blank and simply traced the outline of the inside of the handle. Then I cut and sanded the block to shape. A thin piece of wood is then screwed to the block to serve as a turnbutton.

TOE BLOCK. Making the toe block is even easier. You start by cutting a groove along the edge of the blank (detail 'a'). Next, trim off the front edge of the block to create a lip (detail 'b'). A small chamfer completes the block. Finally, both blocks are screwed in place to the back of the saw till.



Trestle Table Rail Supports

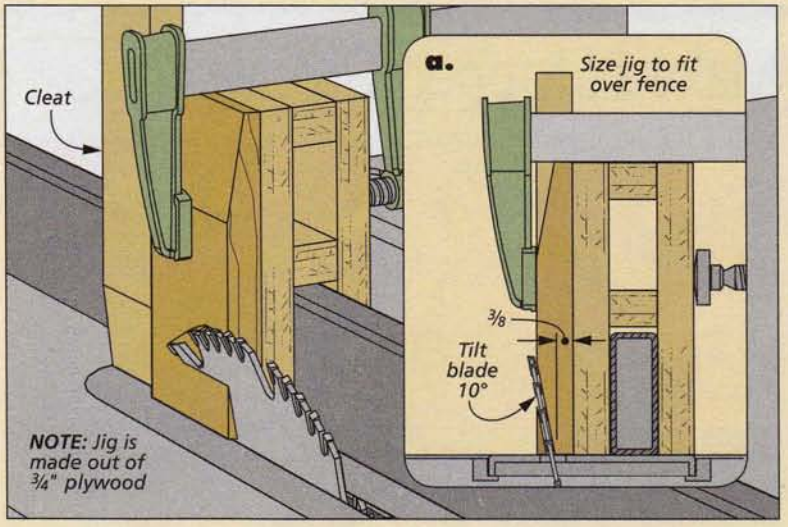
To help strengthen the sliding extensions on the trestle table shown on page 28, I added some rail supports. These are nothing more than short blocks of wood notched to fit around the rails. To avoid hitting the supports with your knees when sitting at the table, I softened the ends with a wide bevel, as you can see at left.



NOTE: Rail supports are screwed to the underside of table to reinforce extension rails

I cut these bevels on the table saw by tilting the blade 10°. To help support the workpiece while making the cut, I built a simple saddle jig for my rip fence, like the one shown in the drawing below.

The jig straddles the rip fence and provides a surface for clamping the workpiece on end. A cleat backs up the workpiece and holds it at a right angle to the saw table as you cut the bevel.



Tabletop Fasteners

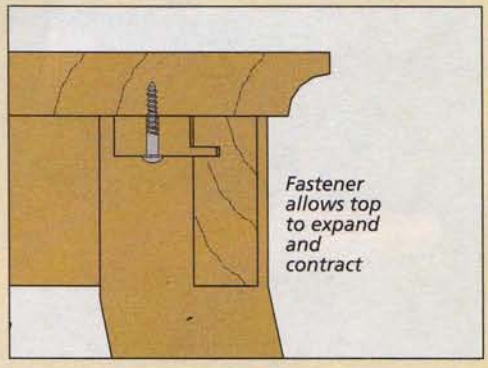
The shelf and top of the bookrack on page 20 are attached to the base with metal tabletop fasteners. The fasteners are nothing more than metal clips that fit into grooves (kerfs) on the inside of the rails.

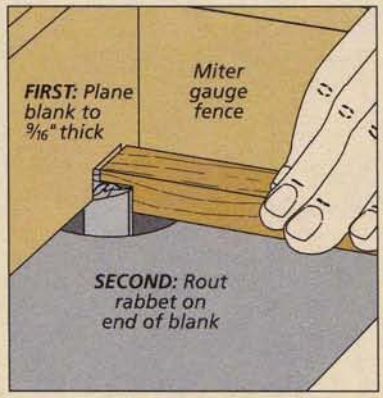
SHOP-MADE OPTION. These fasteners allow the workpiece to expand and contract with changes in humidity. But rather than buying tabletop fasteners, another option is to make your own out of wood.

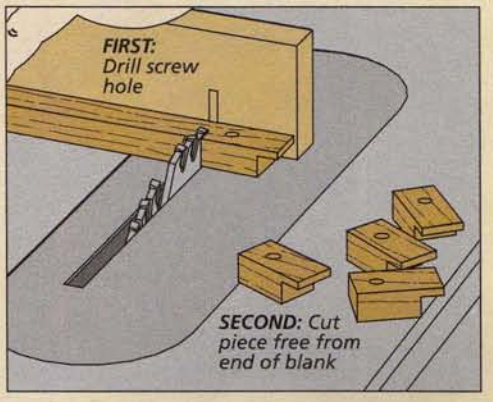
The shop-made fasteners are really nothing more than small blocks of wood that are rabbeted to form a tongue on one end. This tongue fits into the kerf in the rails. The trick is to orient the grain of the fasteners in the proper direction for maximum strength.

To make the fasteners, I start by planing down a long, ¾"-wide blank. Using a straight bit at the router table, cut a rabbet on the end of the strip to create a tongue (lower left drawing). This tongue is sized to fit the groove in the rail (drawing at right).

After drilling a hole for the mounting screw, you can cut the fastener to length (lower right drawing). Then you can go back to the router table and start the process over again, making as many fasteners as your project calls for.







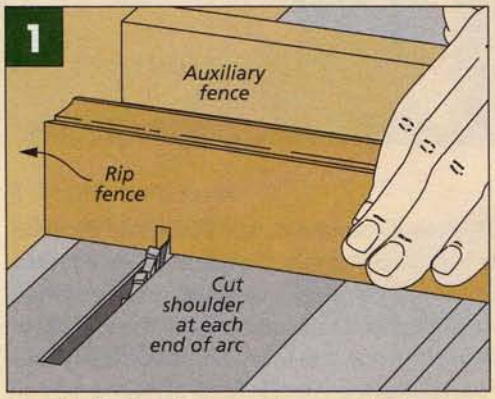
Cutting a Stopped Arc

A band saw is great for cutting curves or arcs. So naturally, this is the tool I turned to when it came time to cut the arc on the base of the mantel clock. But if you take a look at the photo at right, you'll notice that there is a shoulder at each end of the arc. This makes cutting the arc a little bit more challenging.

To do this, I start by cutting the shoulders of the arc on the table saw. Raise the blade just high enough to establish the shoulder. You can use the fence as a stop, as shown in Figure 1. Then just flip the workpiece around to cut the opposite shoulder.

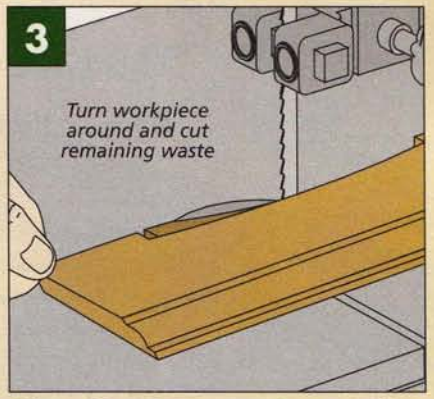
The arc is cut in two separate passes. This allows you to cut cleanly into both corners of the shoulders. As you can see in Figure 2, the first pass removes most of the waste. Then come back and make a second cut in the opposite direction to remove the remaining waste (Figure 3). Finally, a little sanding will smooth out the edge of the arc profile.

▲ The front base trim of the mantel clock features a stopped arc that terminates in a shoulder at each end.

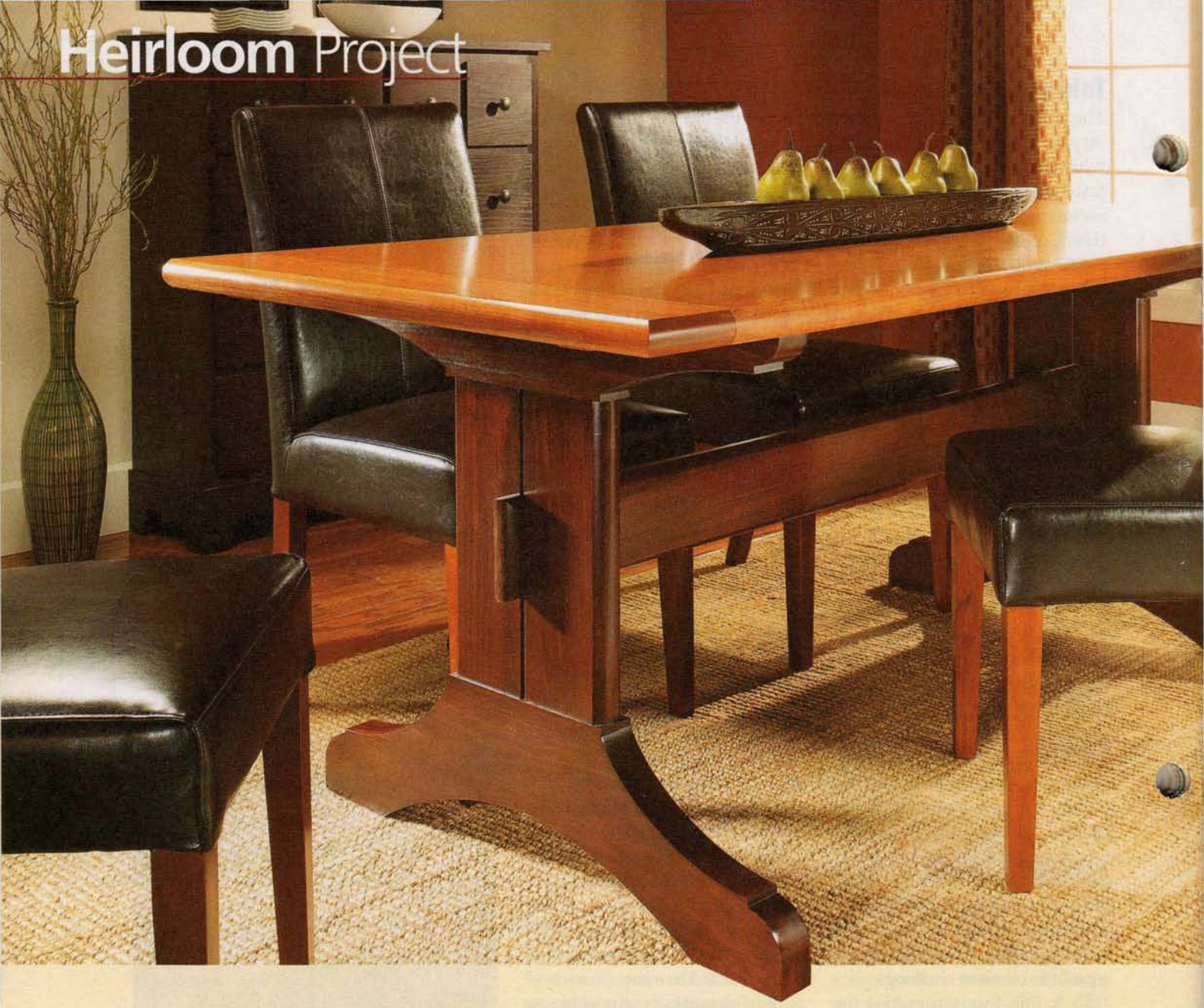


Establish Shoulders. *Using the rip fence as a stop, raise the blade just high enough to cut the shoulders at the ends of the arc.*

Cut into Shoulder. *To remove the bulk of the waste, start near one end of the arc and stop the cut at the corner of the shoulder.*



Clean Up. *To remove the remaining waste, turn the workpiece around so you're cutting into the opposite corner.*



slide-out Trestle Table

This twist on a traditional design makes room for extra seating. And with a few simple techniques, you'll have the table done quickly.

The inspiration for this table comes from traditional trestle table design. It features a large, breadboard top on a sturdy base. But it has an interesting twist — each breadboard end slides out to accept a leaf.

It's not often you find a trestle table that expands. And if you do, the top splits in the middle for the drop-in leaves. But with the leaves on the ends, there's no need to build an elaborate expanding base. Just pull the ends out and add the leaves.

The table is built around a sturdy base that includes a stretcher to keep it stable. Simple, straightforward joinery keeps the stretcher in place. And a simple system of guides and rails underneath the top allow the ends to slide out smoothly and effortlessly. But the best part is, the top is made from plywood, so you don't have to fuss with a complicated glueup. The leaves are also cut from the same sheet of plywood, so matching them to the top is a piece of cake.

CONSTRUCTION DETAILS

OVERALL DIMENSIONS: 72"L (90" Extended) x 36"W x 30"H

Leaves at end of table create room for extra seating

Cherry plywood top makes building a smooth table surface a snap

Breadboard ends pull out to accommodate leaves

Frame keeps top stable and creates track for extensions

Brackets offer extra support to tracks

Bullnose edging hides plywood edge

Breadboard ends are supported by extension rails

***NOTE:** Table seats six or eight when fully extended*

Bolts attach top to base

Patterns for cutting legs and arms are shown on page 31

Bullnose profile softens edges of stretcher and legs

Two legs wrap around stretcher to create rock-solid base

Ends of stretcher are notched to fit between legs

***NOTE:** Feet and arms are glued up from two layers*

***NOTE:** Base is made from poplar*

Through mortises are created by cutting dadoes in both halves of feet before glueup

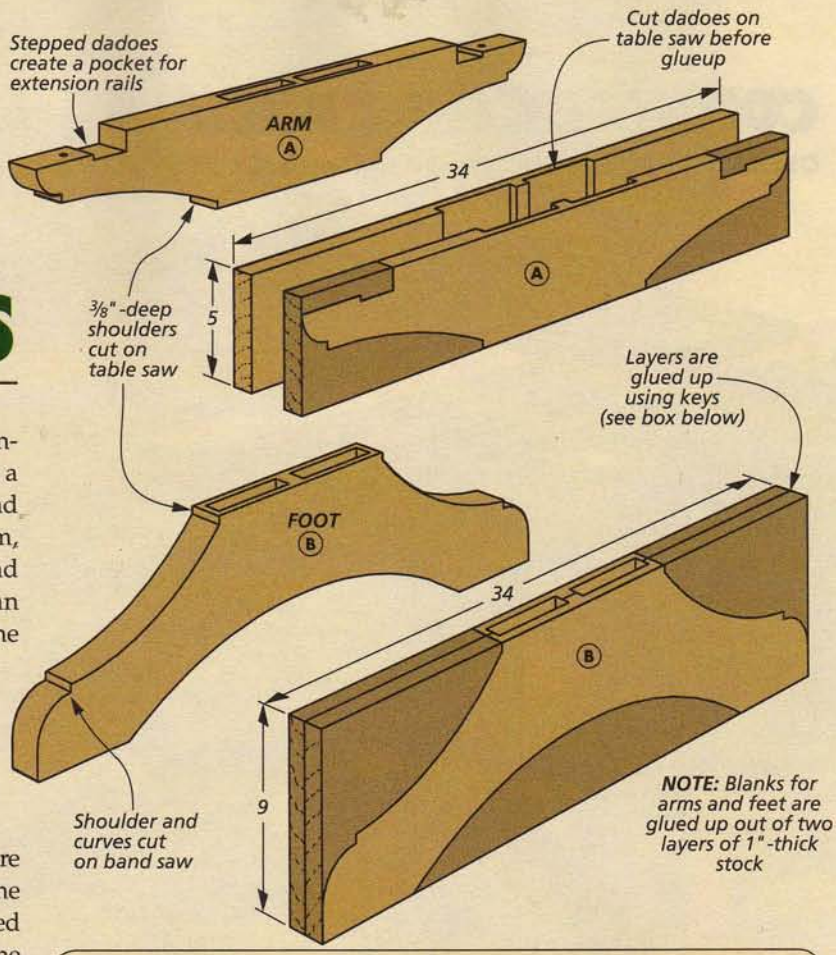
▲ Breadboard ends on the table pull out to make room for drop-in leaves, creating extra seating space.

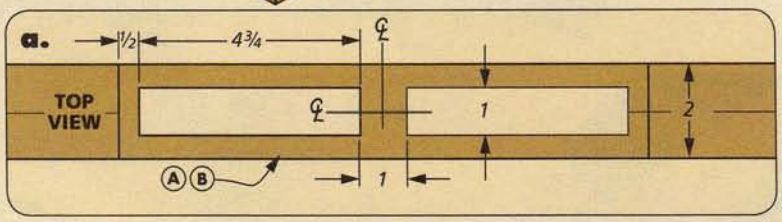
Extension rails are recessed into breadboard ends

Extension stop

Locks on table and leaves keep extended top in place

making the FEET & ARMS





The base of the table has two identical trestle ends connected with a single stretcher. Each trestle end has a foot, two legs, and an arm, held together with mortise and tenon joinery. But rather than chopping out the mortises in the feet and arms, I used a simpler method on the table saw.

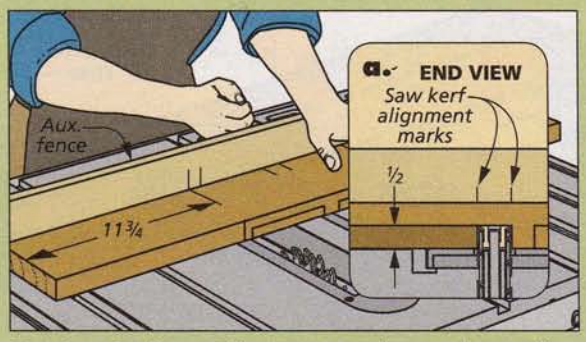
The blanks for the feet and arms are glued up from two layers of 1"-thick stock. The trick is to cut matching dadoes in each half of the workpieces before they're glued up. Then when the two halves of the blank are glued together, the dadoes will form the mortises for the leg tenons.

MORTISES. You can cut the dadoes on the table saw using a dado blade. Just mark the location of each, as shown in detail 'a,' and nibble away the waste between the lines (How-To box below). Both the feet and the arms have the same size mortises, so you can cut the dadoes on all the pieces with the same table saw setup.

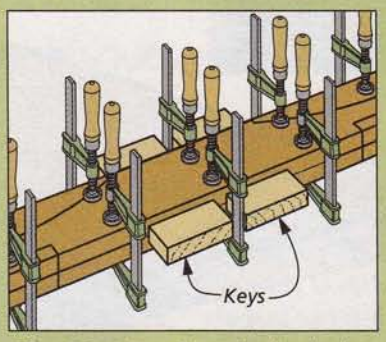
To keep the dadoes aligned during glueup, I used waxed keys. You'll find more about this in the How-To box below. Once the glue is dry, you can start work on shaping the four separate workpieces.

TABLE SAW WORK. The first step in shaping the arms and feet is to spend some time at the table saw cutting the straight shoulder notches on these workpieces. You can start by transferring the patterns on the opposite page to the faces of the arms and feet. Then cut

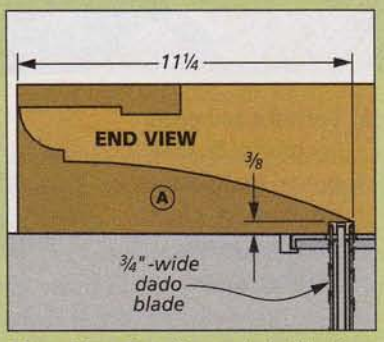
How-To: Glue Up Feet and Arms



Cutting Dadoes. *Alignment marks on the auxiliary fence and the workpiece allow you to cut the dadoes in the arms and legs accurately.*



Glue Up. *Waxed keys in the dadoes keep the two workpieces aligned during the glueup.*



Shoulder Cut. *Use a dado blade to cut a smooth shoulder in the bottom of the arms and in the feet.*

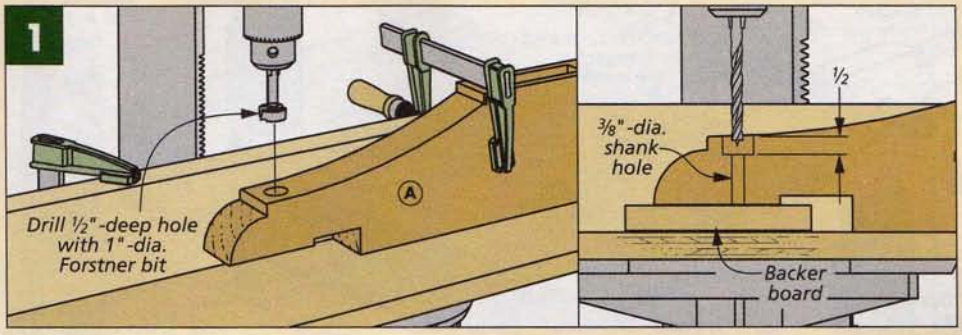
the shoulders at the top of the feet and the bottom of the arms (How-To box on opposite page).

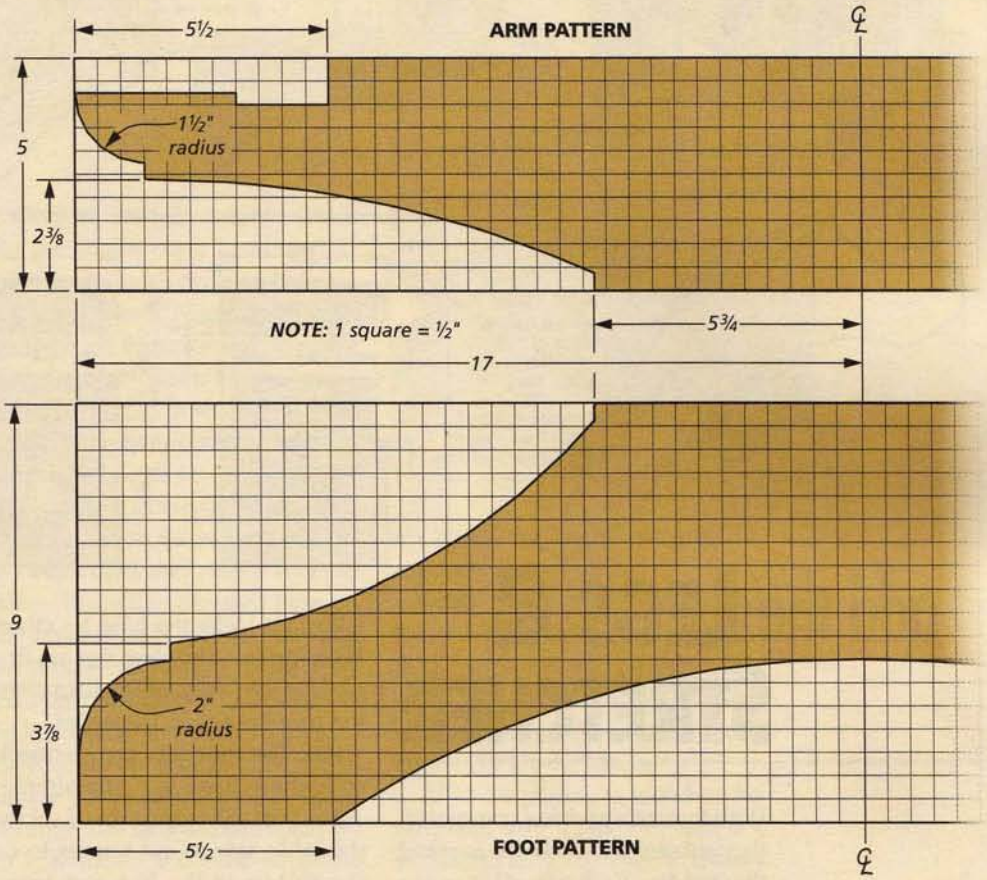
ARM DETAILS. After these shoulders were cut, I turned my attention to shaping the details on the arms. The arms support the top, but they serve a second purpose, too. The sliding extension rails that you'll add later pass through notches in the arms. It's important to position these notches accurately so that the extension rails will slide freely through the notch.

To make sure these notches were cut correctly, I used a pair of stop blocks and a long auxiliary fence attached to the miter gauge. You'll find more information about cutting these notches in the box below.

SHAPING THE FEET & ARMS. Once the notches are cut, you can cut the remaining shoulders and profile on the four workpieces. Just cut to the waste side of the marked lines using a band saw. Then smooth the curves with a sanding drum on the drill press. Finally, you can clean up the shoulders on the four pieces with a chisel.

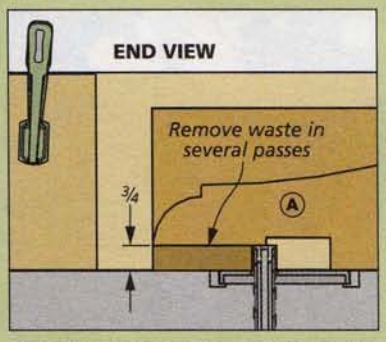
DRILL FOR ASSSEMBLY BOLTS. The final step for the arms is to locate and drill the counterbored holes for the mounting bolts (Figure 1). These holes are for the assembly bolts, which will be added later. They also act as guides in the next part of the assembly, so you'll want to take extra care to position them properly. I drilled these holes using the drill press.



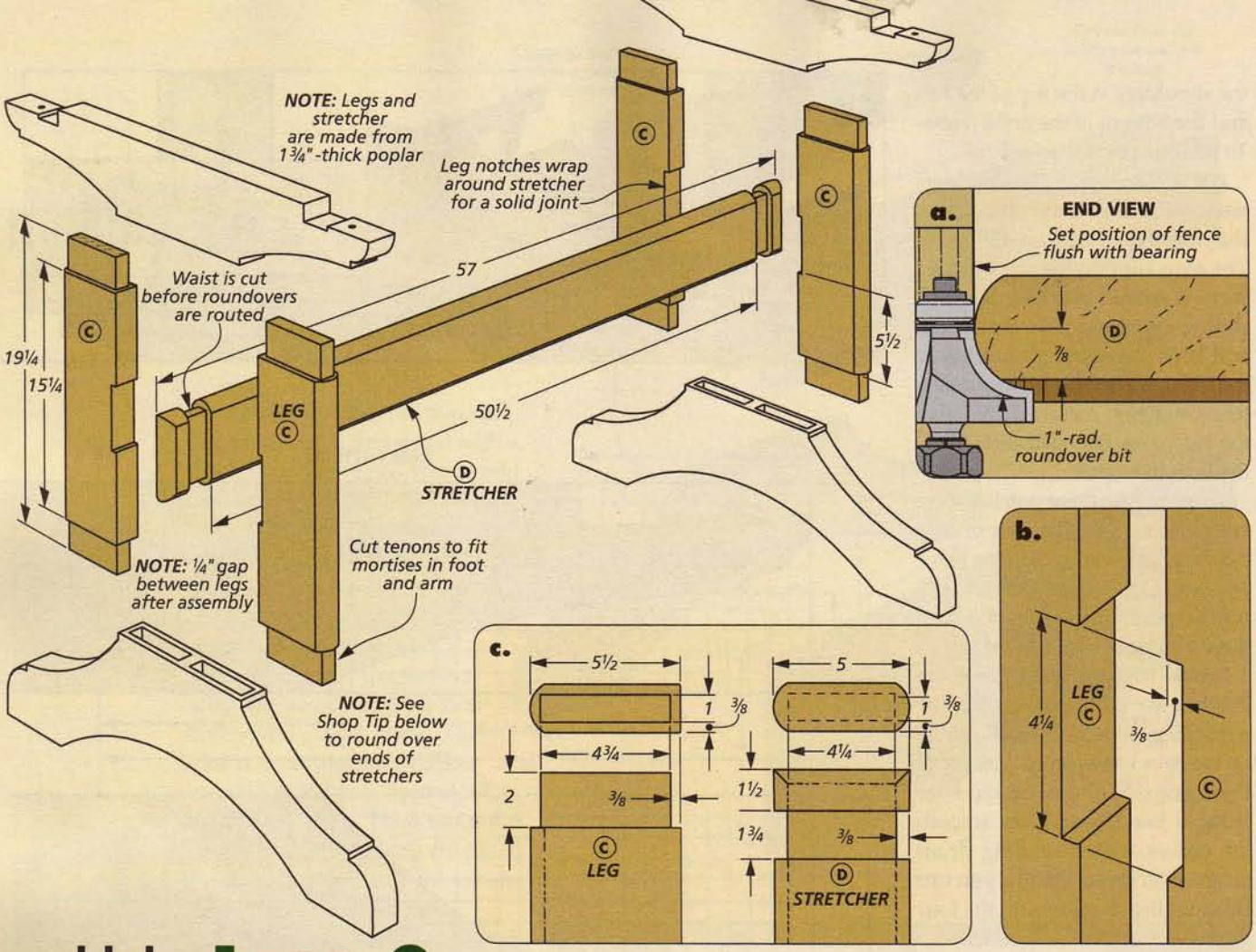


Cut the Arm Notches

Arm Notches. *Attach a stop block to each end of an auxiliary fence to establish the shoulders. After cutting the inside shoulder, cut away the rest of the waste in multiple passes, until you reach the opposite stop block. Then flip the workpiece around to cut the other notch.*



Remove Waste. *To complete the notch, lower the dado blade and nibble away the remaining waste.*



add the LEGS & STRETCHER

With the arms and feet completed, the next step is to make the legs and the stretcher. Each pair of legs wrap around the stretcher to form a solid joint that locks the base together. Both the legs and stretcher are finished at the router table with matching roundovers on the edges.

LEGS. The four legs are identical, so making them is pretty simple. After I cut the legs to size, I set up the table saw to cut tenons to fit the dadoes in the feet and arms. It's a good idea to start with the blade a bit low. This way, you can sneak up on the height so the tenons fit the mortises snugly.

Next, I cut the notches on the legs that will wrap around the stretcher. Just lay out the location of the notches, as shown the drawing above and detail 'b,' and cut to the lines, using the rip fence as a stop.

The final step is to rout the profiles on the outside edges of the legs. I used a 1"-rad. roundover bit in the router table. Detail 'a' shows the setup. Test the cut on a scrap piece first. This will let you make sure you have the profile just right.

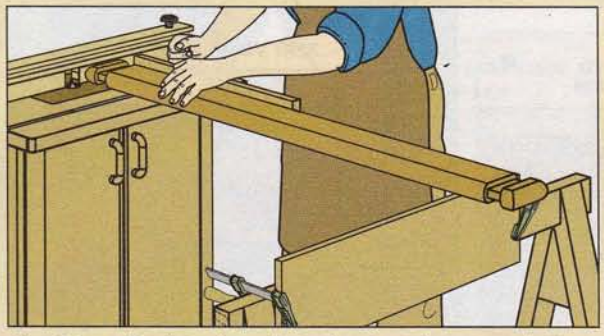
STRETCHER. Adding the stretcher that connects the two trestle ends is pretty straightforward. It's just a long piece that's notched to create a narrow "waist" near each end. The key to laying out these cuts is to pay close attention to the distance between the two notches. This distance determines the spacing of the legs on the top during the final assembly, so it needs to measure exactly 50½".

After cutting away the waste, you can rout the edges and the ends with a 1"-rad. roundover bit, using a fence for the edges and a miter gauge and backer board for the ends. The Shop Tip at left shows the setup I used to rout the ends.

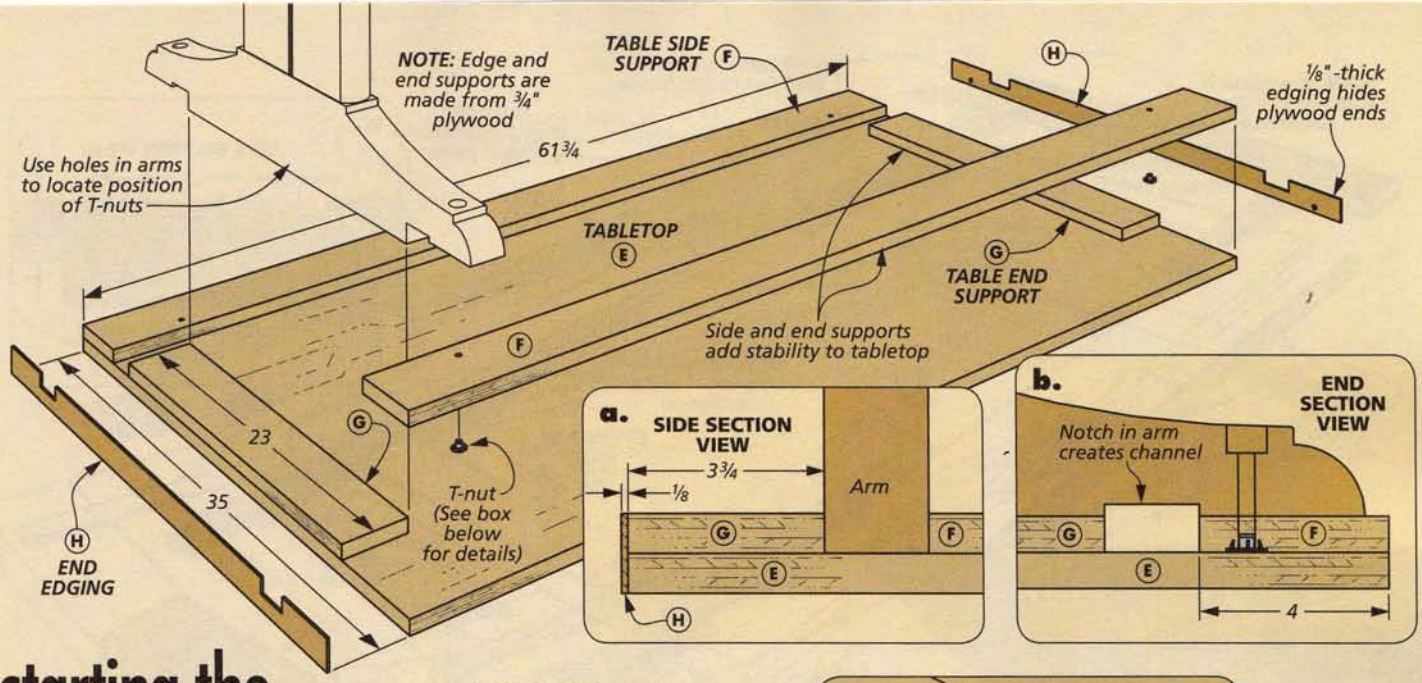
ASSEMBLY. It's a good idea to spend a little time dry-fitting the base before you add the glue. You can clamp the stretcher between the notches in the legs and then add the feet and arms to the assembly. This way, you'll know that everything fits well and is square.

Once you're sure that the base fits, just add glue and you're ready to start working on the top.

Shop Tip: Third Arm



Stretcher. *By clamping a board to a sawhorse and adjusting the height to match the router table, you'll have plenty of support for the stretcher while you rout the ends.*



starting the TOP

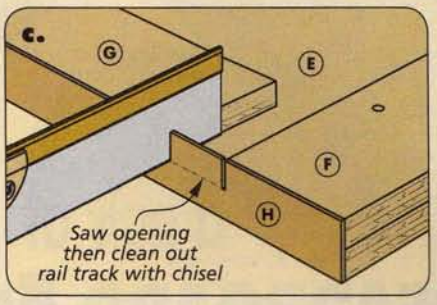
I wanted this table to be a traditional trestle table, but one that was easy to build, so I chose plywood to make the tabletop. The single layer of ¾" plywood is strengthened with supports glued to the underside that double as guides for the extension rails.

CUT TO SIZE. To ensure I had a continuous grain match when the leaves are in place, I cut the top and the two leaves from a single sheet of plywood. I started by ripping the plywood to final width, then cut a leaf off of each end. It's a good idea to mark the leaves before setting them aside to complete the top.

LOCATE THE T-NUTS. In order to attach the top to the base, I installed T-nuts in the underside of the top. Locating these T-nuts is a little tricky, but I found a way to make sure they're right on the money.

The first step is to cut the table side and end supports to size, but don't glue them on yet. With the tabletop face down on your workbench, position the supports on the outside edges and clamp them in place. Place the inverted base on the tabletop and center it, matching the notches in the arms to the table side supports on both sides (How-To box below and detail 'a').

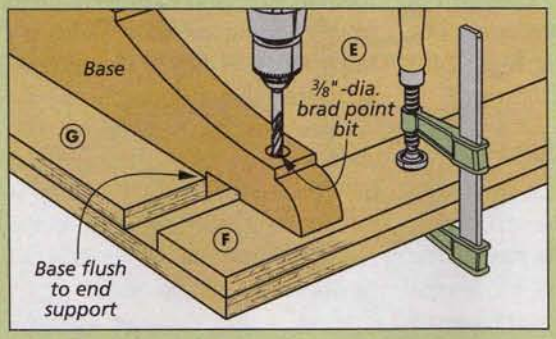
Now use the counterbored holes in the arms to drill pilot holes through the side supports (detail 'b'). Remove the side supports and use the pilot holes to drill the counterbore for the T-nut. To finish up, install the T-nuts and glue the supports to the top.



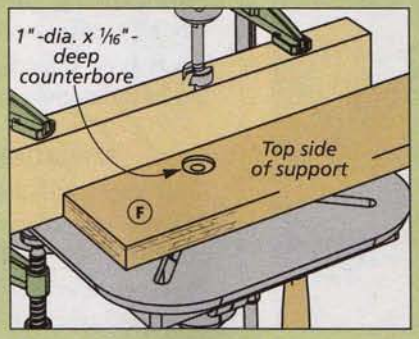
EDGING. Next, I made edging for the plywood ends by cutting ⅛"-thick strips from 1½"-thick hardwood. It's a good idea to cut some extra strips now — you'll need them later for the leaves.

After the edging is glued to the tabletop, you'll need to make a small opening for the extension rails. I used a handsaw and chisel to make the opening (detail 'c').

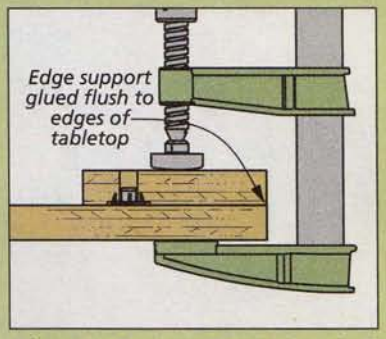
How-To: T-Nut Details



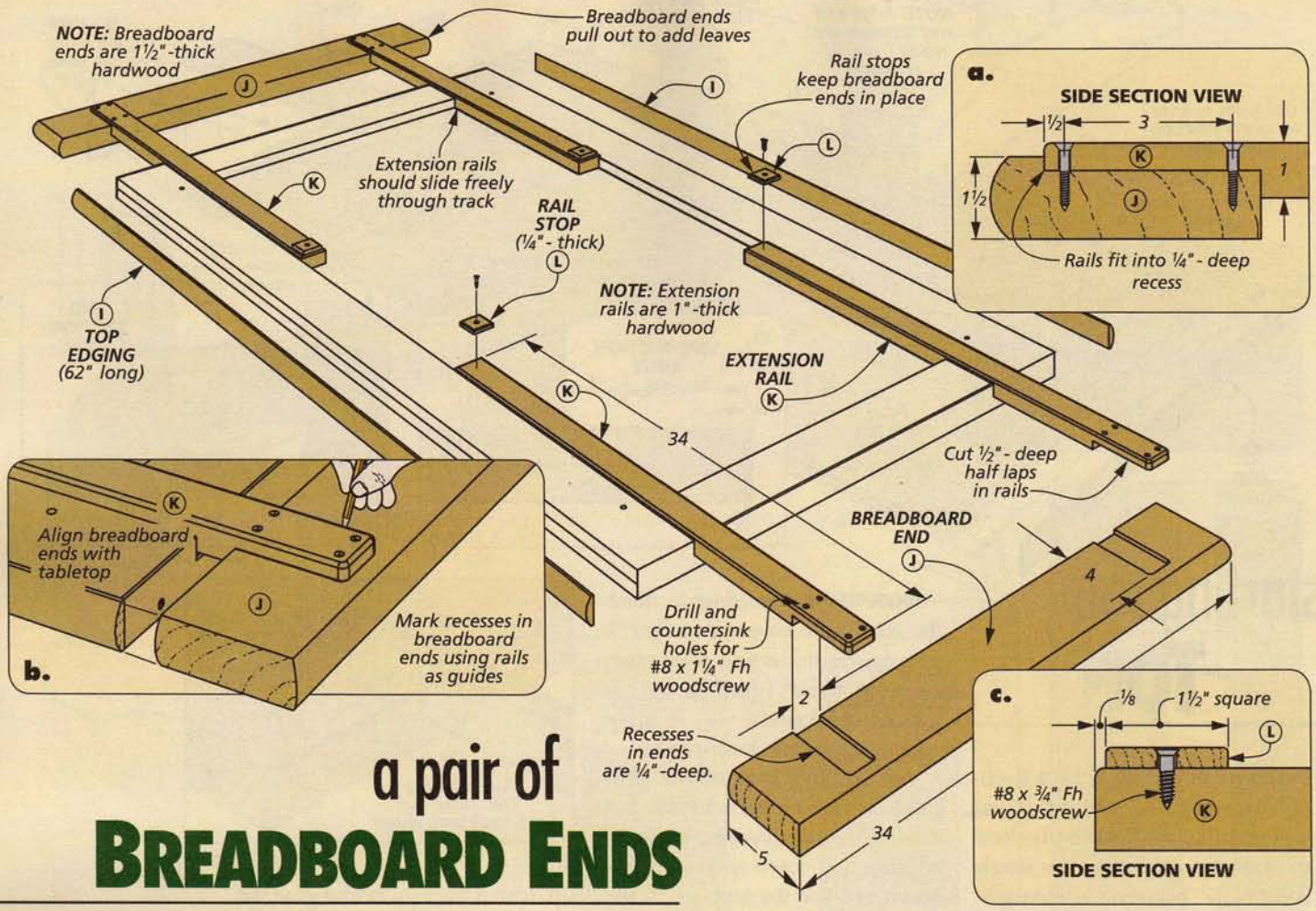
Pilot Hole. *After positioning the supports and base, use the shank hole in the arm to drill a pilot hole in the side support for the T-nut.*



Counterbore. *Center a Forstner bit over the pilot hole and drill out the counterbore for the T-nut.*



Glue Up. *Once the T-nut is installed, the side and end supports can be glued in place on the tabletop.*



a pair of BREADBOARD ENDS

One of the nicest features of this table is the breadboard ends that slide out to accommodate the drop-in leaves. But before starting work on this extension system, you'll need to add edging to the plywood tabletop and supports.

TABLETOP EDGING. The top edging is cut with the same router bit used on the legs and stretcher. The box at the bottom of the opposite page shows how I did the job. It's a good idea to make enough edging for the top and the drop-in leaves. You'll want to leave some extra length on the edging and then trim it flush after it's glued in place.

ATTACH THE EDGING. Attaching the edging to the top is a challenge. Once glue is applied, things get a bit slippery. So to help keep the edging aligned, I nipped the heads off some short brads and drove several along each edge. Then before adding glue, I pressed the edging in place over the brads. The brads keep the edging from shifting as the clamps are tightened.

Shop Tip: Small Pieces

▲ A push block and an auxiliary fence and tabletop with openings cut to fit the router bit make routing the rail stops a little safer.

BREADBOARD ENDS

Breadboard ends are usually added to a tabletop to keep the surface flat. Since this tabletop is plywood, the breadboard ends serve a different purpose. Instead, they form part of the extension system.

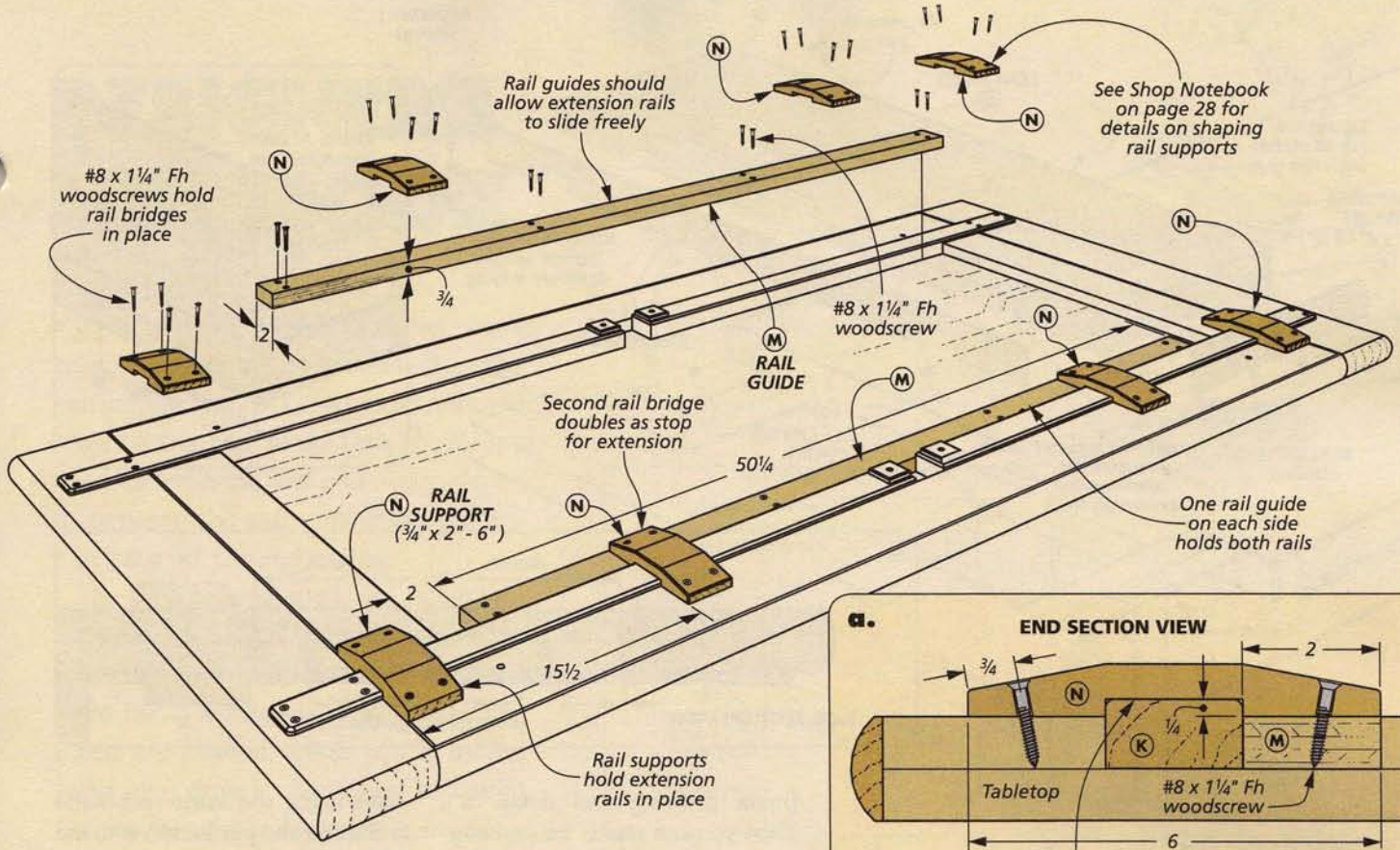
The breadboard ends pull out on extension rails that slide in a track created by the end and side supports and the rail guides you'll add later. The extension rails have a dual purpose. They hold the breadboard ends in place and they also support the table leaves when they're being used.

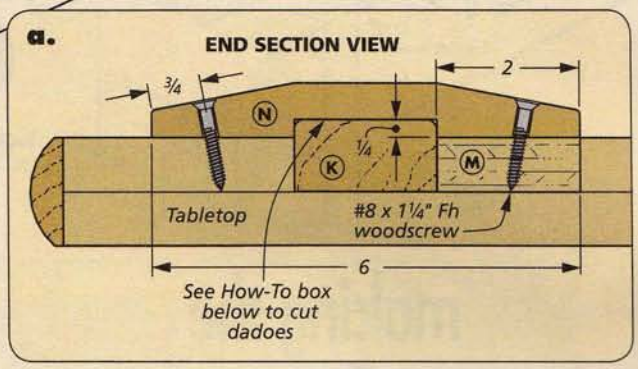
The first step to adding the extension system is to make the breadboard ends. After they're cut to size, round over the ends and one side with the same router table setup used for the top edging.

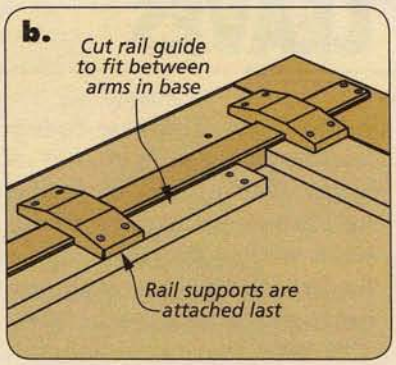
EXTENSION RAILS. The extension rails come next. First, you'll need to cut them to size. And to prevent them from binding as they slide, it's important that they're straight and accurately dimensioned.

Once the rails are ready, you can start work on joining them to the breadboard ends. The first step is to cut a long rabbet or notch in the ends of the rails (detail 'a'). This can be done with a dado blade.

Next, I laid out the shallow recesses in the breadboard ends that hold the notched ends of the rails. To locate the recesses, I placed







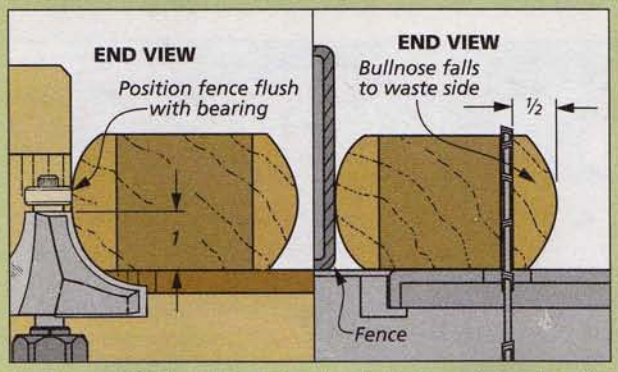
the rails in the track and lined up the breadboard end with the top, as shown in detail 'b' on the opposite page. Then I simply marked around the rails.

The quickest way to form the recess is to use a hand-held router and a straight bit. Once this is completed, you can attach the rails with screws (detail 'a,' opposite).

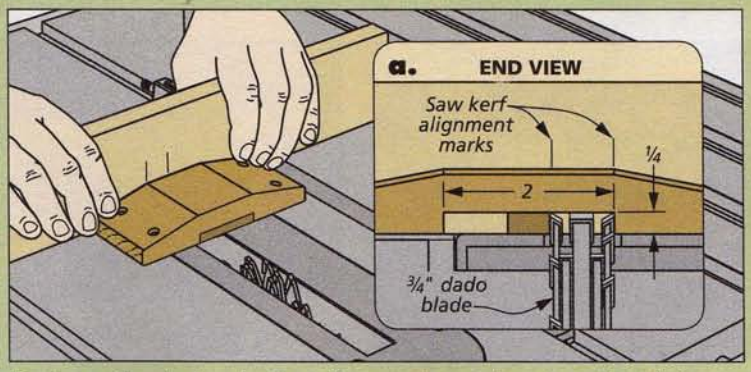
RAIL GUIDES. Now you can add the rail guides. These form the inside edge of the track and are attached to the underside of the tabletop with screws, as shown above. You want a snug, but not tight, fit. The extension rails should slide freely along the track (detail 'b').

RAIL BRIDGE SUPPORTS. The last pieces to add at this stage are the rail stops and the supports that trap the extension rails (details 'a' and 'b'). The Shop Tip on the opposite page shows how to shape the stops before gluing them in place. You'll find more on making the rail supports in the box below and Shop Notebook on page 28.

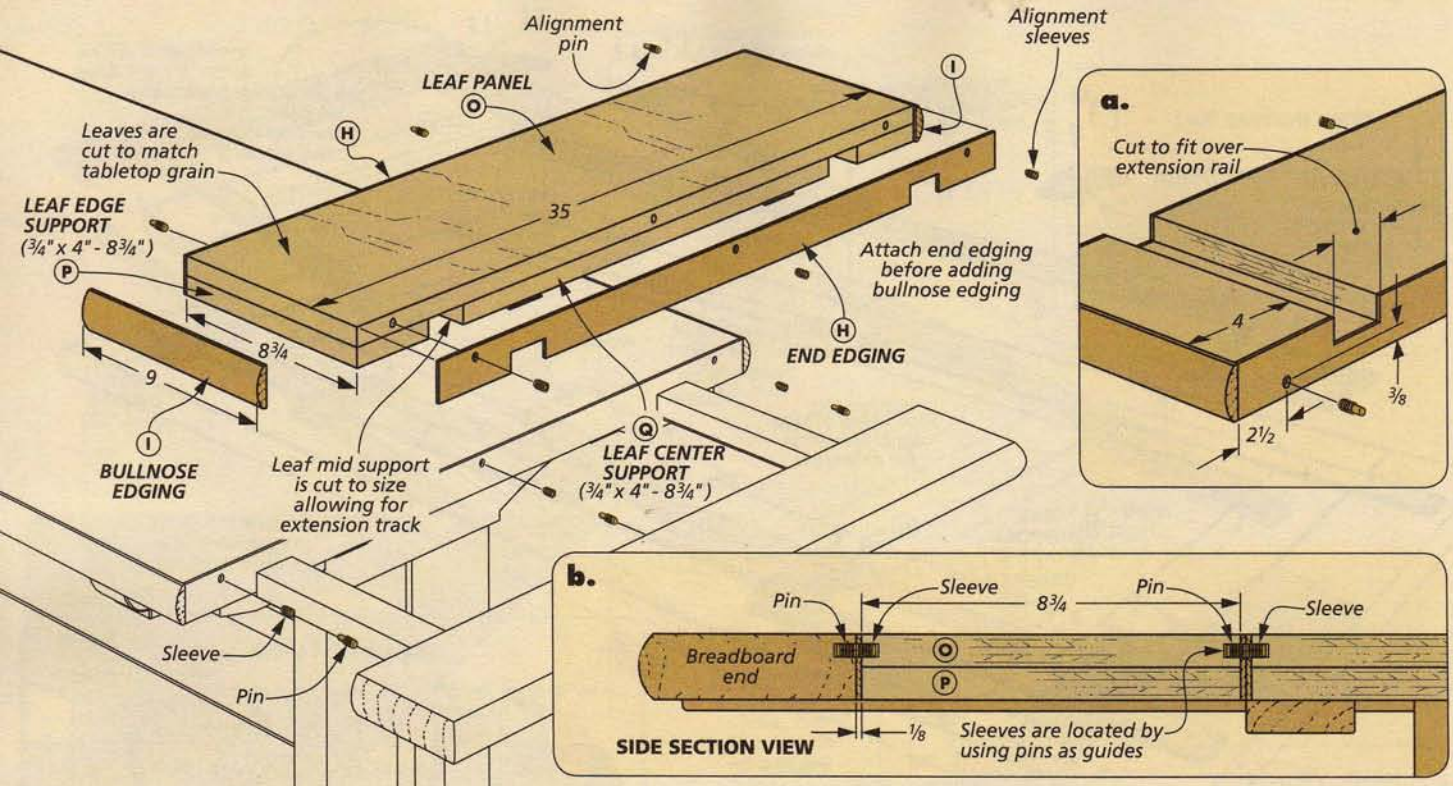
How-To: Construction Details



Bullnose Edging. *To make the bullnose edging for the top, rout the profile on both edges of a wide workpiece. Then cut the edging free at the table saw.*



Dadoes. *The dadoes in the rail supports can be cut on the table saw. Mark a line on the auxiliary fence at either edge of the dado blade. Then use these lines as a guide to remove the waste.*



making the LEAVES

Adding a pair of leaves to the trestle table gives you an extra 18" of length. They're simply made from the plywood pieces you laid aside when you cut the tabletop. And finally, adding some alignment hardware will complete the table.

THE LEAVES. Making the leaves is pretty straightforward. With the two panels for the leaves cut to size, you start by adding the end and center supports that will form channels for the extension rails (main drawing and detail 'a'). Then you can attach the end edging and then the bullnose edging, as shown in the main drawing. This is done with the same procedure you used for the tabletop.

HARDWARE

To keep the breadboard ends, leaves, and top aligned, I added table alignment pins. I also installed locks to hold everything together, as in the photo below.

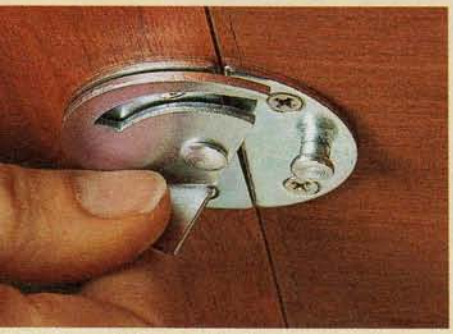
PINS. Locating the pins can be tricky. But again, I turned to nipped-off brads for help.

All you need to do is drive brads into the breadboard ends wherever a pin will be installed (See detail 'a' for the pin locations.) Then push the breadboard ends against the top to transfer the pin locations. After using the same technique to transfer the pin locations to the edges of the table leaves, you can go ahead and drill the holes for the pins and sleeves.

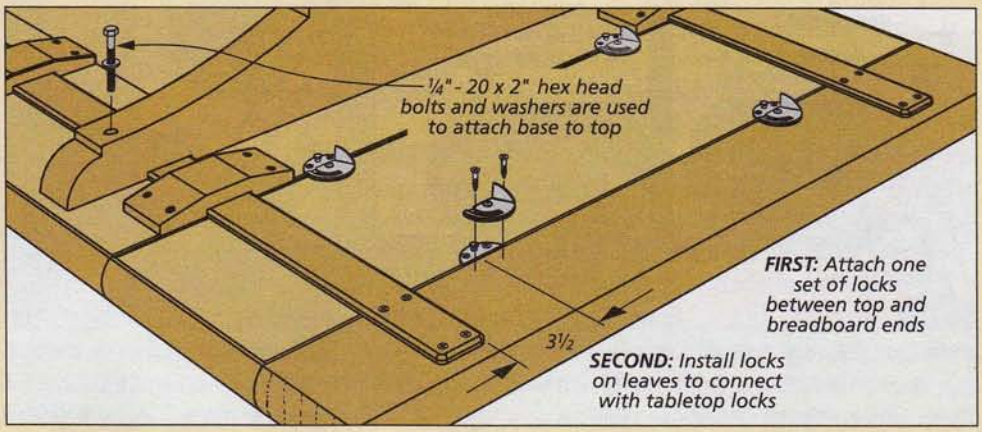
To finish up the table, all you need to do is attach the locks to the leaves, ends, and tabletop, as shown in the drawing below. The locks will help keep the table secure when the leaves are in use.

ATTACH THE BASE. Since the T-nuts used to bolt the top to the base are already in place, it's a simple matter to finish the assembly of the table. All you need to do is position the top on the base and tighten down the bolts.

After you've applied a finish to the table (see Sources for more information), you can invite some folks over for a hearty meal. W



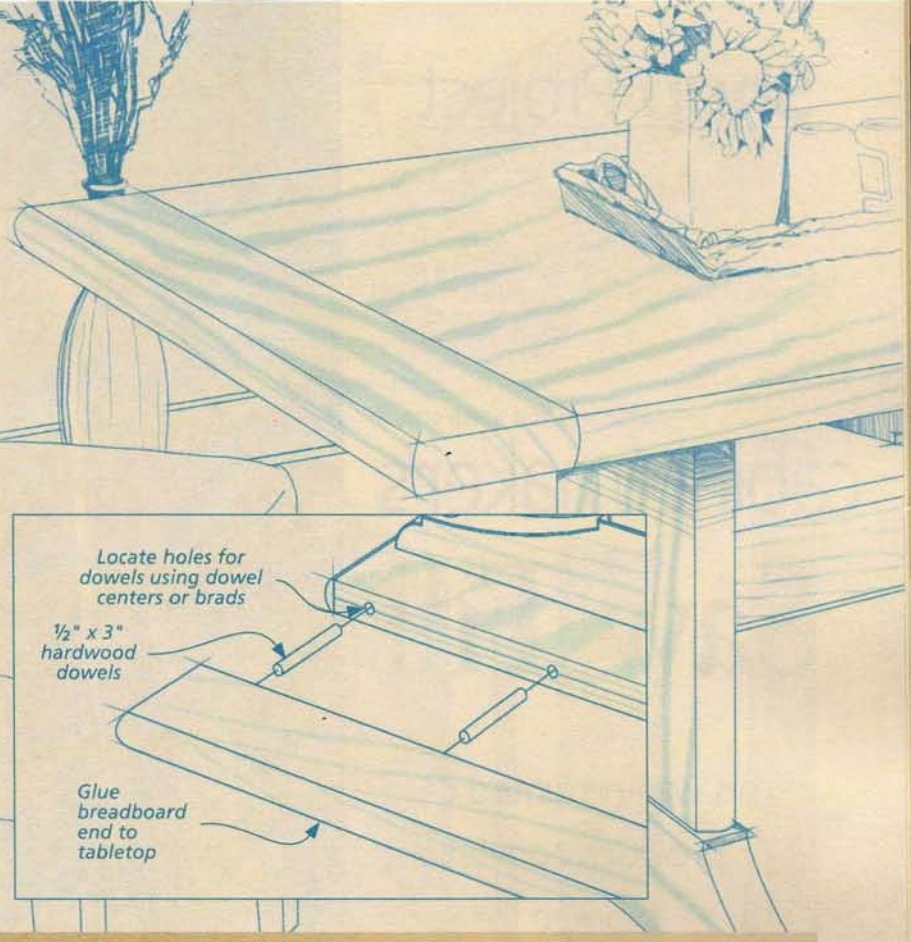
▲ Installing locks between the top and the leaves keeps them from separating when in use.



DESIGNER'S NOTEBOOK

If you don't need the extra seating space that the table leaves provide, then you can permanently attach the breadboard ends to the top. To do this, you'll first need to lengthen the end supports to fit between the side supports. And you can leave off the end edging.

The breadboard ends are attached with dowels. I drilled five corresponding holes in the table top and breadboard ends. Using a doweling jig will ensure the holes are aligned. After you've added some glue, drive in the dowels and push the breadboard ends over the dowels.



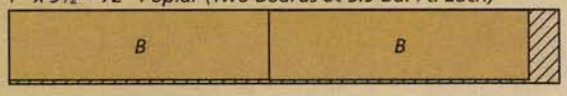
Materials, Supplies & Cutting Diagram

A	Arms (2)	2 x 5 - 34
B	Feet (2)	2 x 9 - 34
C	Legs (4)	1¾ x 5½ - 19¼
D	Stretcher (1)	1¾ x 5 - 57
E	Tabletop (1)	¾ ply. - 35 x 61¾
F	Table Side Supports (2)	¾ ply. - 4 x 61¾
G	Table End Supports (2)	¾ ply. - 3¾ x 23
H	End Edging (6)	⅛ x 1½ - 35
I	Bullnose Edging (2)	½ x 1½ - 96 rgh.
J	Breadboard Ends (2)	1½ x 5 - 36
K	Extension Rails (4)	1 x 2 - 34
L	Rail Stops (4)	¼ x 1½ - 1½
M	Rail Guides (2)	¾ ply. - 2 x 50¼
N	Rail Supports (8)	¾ x 2½ - 6
O	Leaf Panels (2)	¾ ply. - 8¾ x 35
P	Leaf Edge Supports (4)	¾ ply. - 8¾ x 4
Q	Leaf Ctr. Supports (2)	¾ ply. - 8¾ x 23

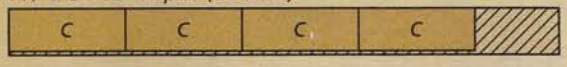
- (4) ¼-20 Pronged T-nut
- (4) ¼-20 x 2" Hex Bolts
- (4) ¼" Flat Washers
- (4) #8 x ¾" Fh Woodscrews
- (64) #8 x 1¼" Fh Woodscrews
- (12) Table Leaf Alignment Pins & Sleeves
- (8) Table Leaf Fasteners

1" x 10½" - 72" Poplar (6.6 Bd. Ft.)

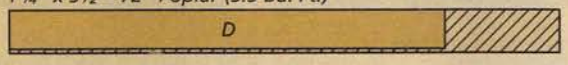
1" x 9½" - 72" Poplar (Two Boards at 5.9 Bd. Ft. Each)



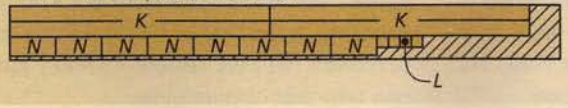
1¾" x 6" - 72" Poplar (6 Bd. Ft.)



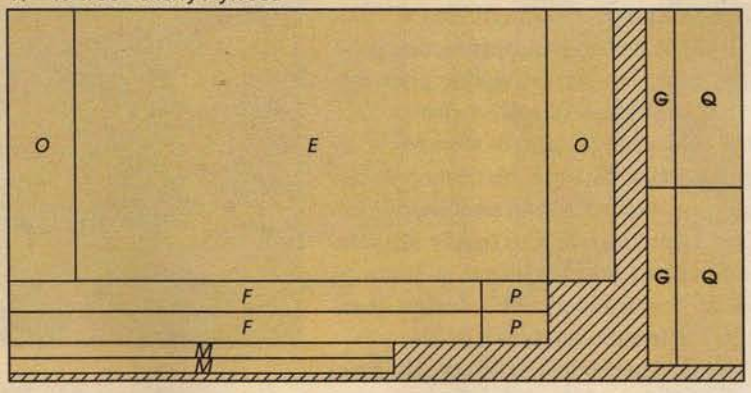
1¾" x 5½" - 72" Poplar (5.5 Bd. Ft.)



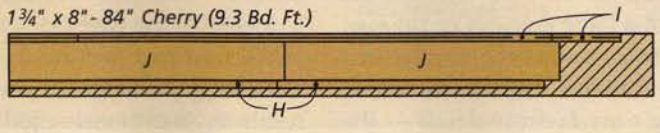
1" x 7" - 72" Poplar (4.4 Bd. Ft.)



¾" - 48" x 96" Cherry Plywood

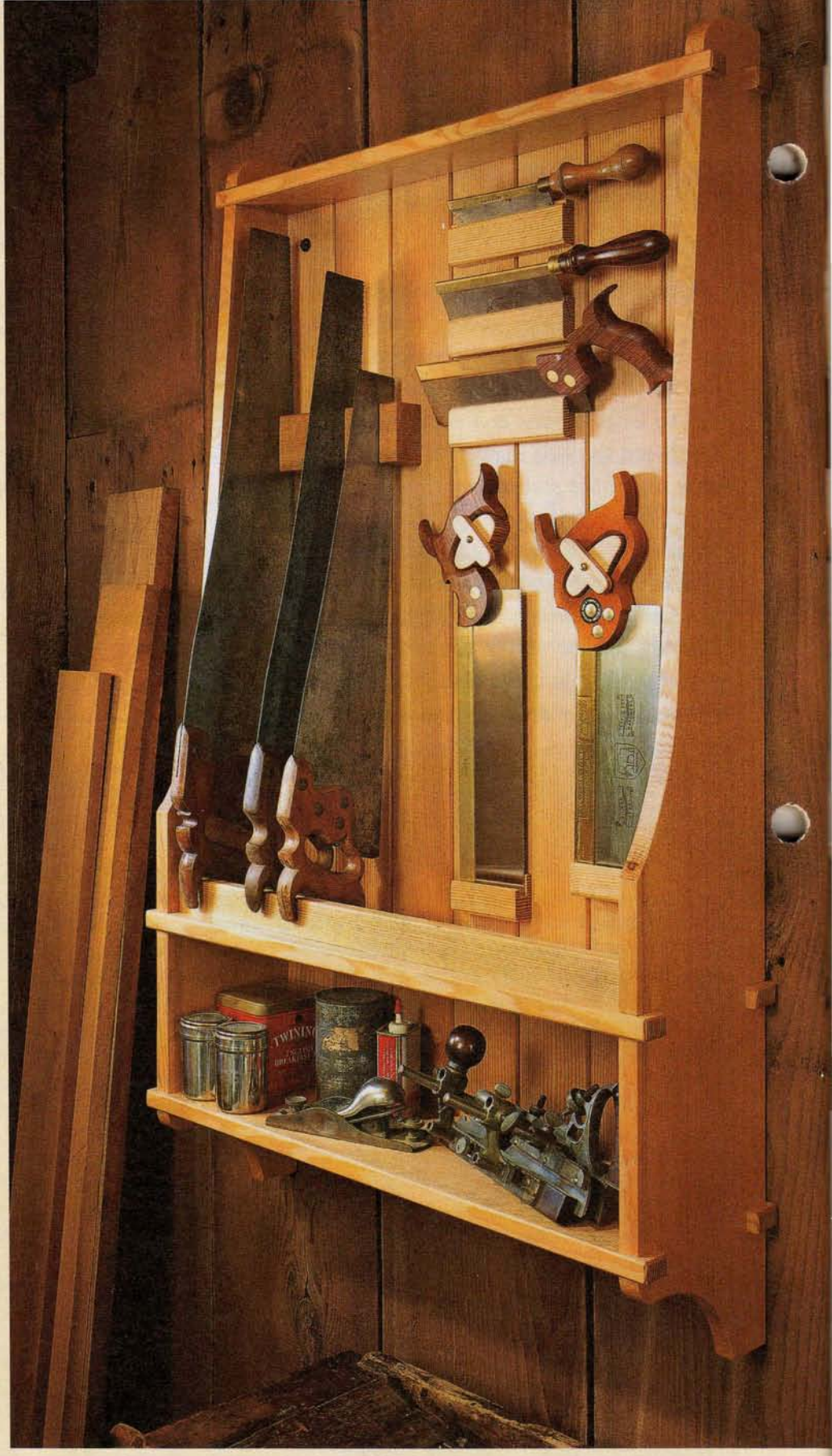


1¾" x 8" - 84" Cherry (9.3 Bd. Ft.)



cabinetmaker's Saw Till

This wall-mounted case provides convenient storage for your handsaws and other treasured hand tools.



A quality hand tool is a lifetime investment. As a matter of fact, many of the saws, planes and chisels that serve me well today started their "careers" in the possession of woodworkers several generations past. One of the keys to this longevity is proper care and storage.

That's what this wall-mounted saw till is all about. The large, upper section provides a safe, convenient resting place for both your large and small handsaws. The shelf below can be used to store some of your most used hand tools or shop items you want to keep within easy reach.

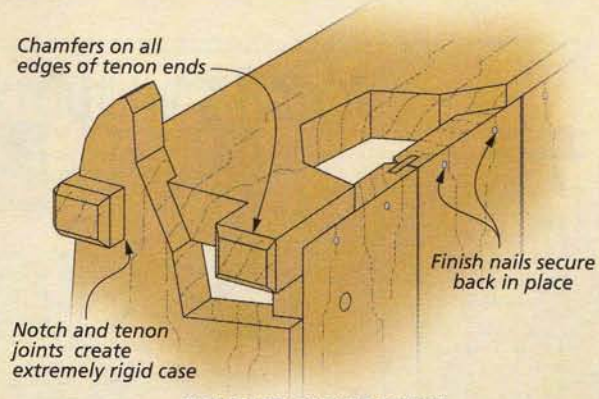
But as you can see, this handy till goes a bit beyond basic practicality. It has a classic "cabinetmaker's" design that befits the traditional tools it holds.

Two design features stand out. The first is the contour of the sides that mimics the taper of a large crosscut or rip saw. As well as being decorative, this lightens the case and makes it easily accessible. Then there's my favorite detail — the unique "notch and tenon" joinery used to assemble the case sides and shelves. You'll find that making this joint is an interesting challenge for your skills and results in an extremely rigid case.

In the end, you'll have a very handy project that showcases both your craftsmanship and some of the tools you use to make it happen. I guess it's really kind of a win-win opportunity.

CONSTRUCTION DETAILS

OVERALL DIMENSIONS: 26½"W x 7¾"D x 46"H



TOP BACK CORNER DETAIL

NOTE: *Till will hold crosscut and rip saws with blade lengths up to 26"*

Decorative chamfer softens edges of shelves

NOTE: *Saw racks are held in place with screws through back*

Simple slotted racks hold small back saws

Slotted keeper supports blades of large handsaws

Profile of side mimics shape of large handsaw

Chamfer on inside edges of back boards

Larger back saws firmly held with turnbuttons and handle blocks

Individual boards joined with splines make up back of case

Toe blocks nestle blades of back saws

Saw handles held by kick bar

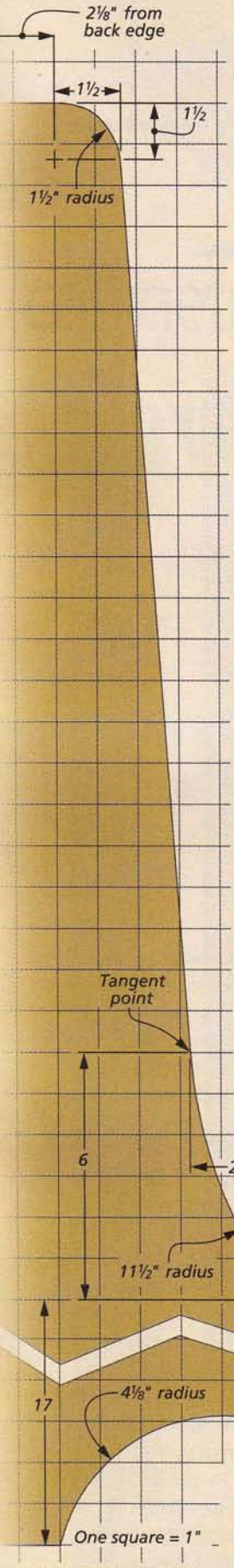
Case is mounted to wall with lag screws

Tenons formed by notching end of shelf

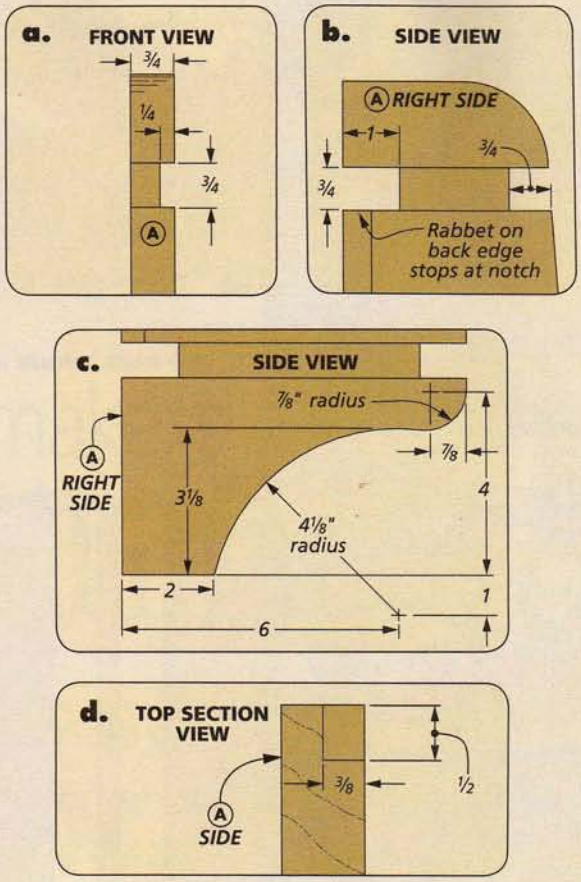
NOTE: *Joinery is cut on table saw*

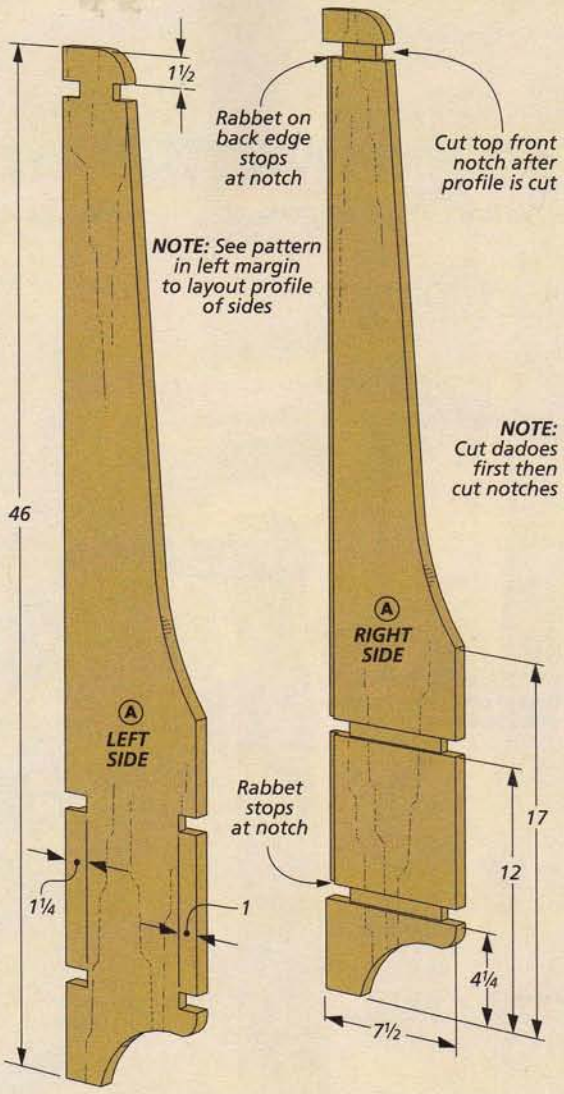
NOTE: *Bottom shelf provides extra tool storage*

Notches in side mate with tenons on shelf



SIDE EDGE PROFILE





making the SIDES

The saw till is constructed like a hanging wall shelf. You have two sides connected by a top, middle and bottom shelf. The middle shelf creates an upper compartment, with large saws hanging vertically and smaller saws stored horizontally. The bottom shelf can be used for additional storage — hand planes, measuring tools or hardware. The back is made from boards joined with splines.

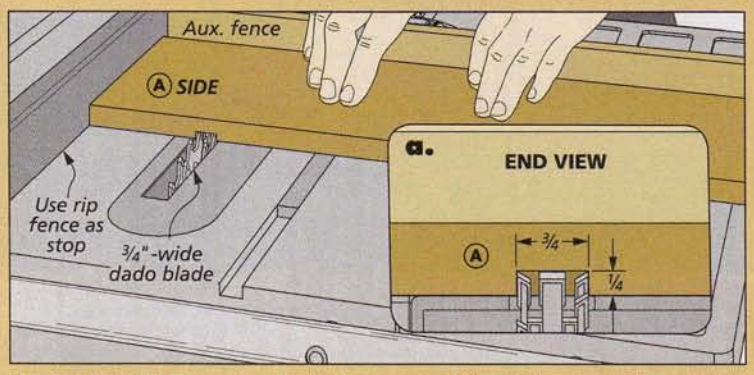
THE CASE SIDES. The order of the work is pretty straightforward. I started by making the two mirror-image sides. A look at the drawings above will show you what's involved.

First comes the joinery. And here, a quick overview is helpful. Each notch and tenon joint starts with a dado cut across the side. Then a notch is cut at each end of the dado. These notches will mate with tenons on the ends of the shelves.

DADOES & NOTCHES. Once the two sides are cut to finished size, you can set up the table saw to cut the dadoes and the notches. All these cuts are easy to make with a dado blade. The drawings below show the setup and the sequence in which I made the cuts.

The fact that the dado and the front and back notch are each a different depth required a choice. For a tight-fitting joint, the dado and notches should align perfectly. You also want to maintain a consistent depth for the corresponding cuts along the sides. The best way to

How-To: Dadoes & Notches



Dado First. *To ensure perfect alignment of the dadoes and the notches that pass through them, make all the cuts with same rip fence setting. I started at the lower end and cut the dado first.*

ensure that the dadoes and their notches align is to set the rip fence as a stop and then make all the matching cuts on both side pieces. This is how I approached the job.

HEIGHT GAUGE AND A SHIM. But this also requires a lot of blade height adjustments. So to be certain the cuts were consistent in depth, I made test cuts in a piece of scrap to create a blade height gauge. This allowed me to quickly and accurately reset the blade for each new set of cuts. Furthermore, I eliminated the need for one of the adjustments by making the shallow notch cuts with a ¼" spacer placed under the side, as shown in the drawing below.

UPPER NOTCHES. There are a couple more things to mention. Due to the taper of the sides, an 8" dado blade doesn't have the capacity to cut the top front notch. So I did this by hand after the sides were cut to shape (right drawing in the box below). And note that these notches are shallower in depth than the lower notches.

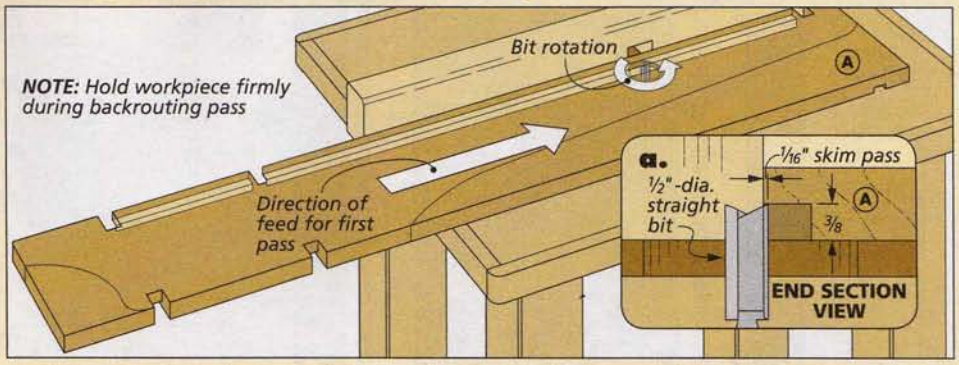
STOPPED RABBETS. Once the work at the table saw is completed, the next step takes you to the router table. Each side needs a stopped rabbet along its back inside edge to hold the back boards.

These rabbets run between the top notch and bottom notch. Since the notches provide ready-made starting and stopping points, routing them is easy. But I did employ a simple trick that guaranteed a smooth chip-free top shoulder — backrouting. The Shop Tip above explains the simple technique.

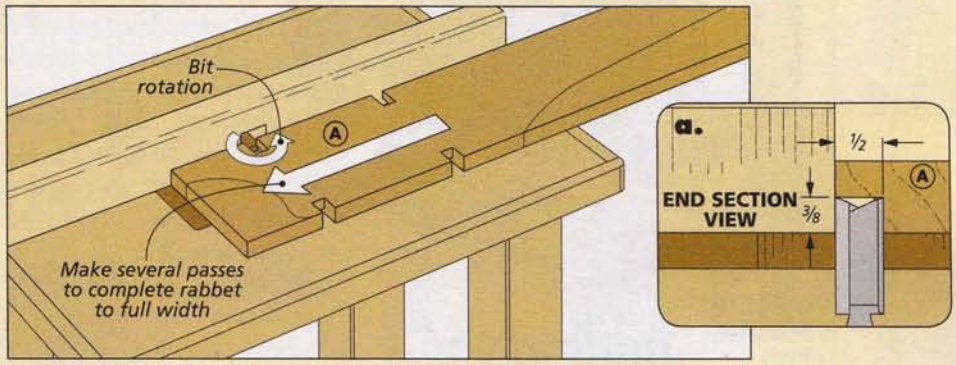
SHAPING THE SIDES. With all the joinery complete, you can now cut the sides to shape. The pattern drawing in the margin of the opposite page has all the information you need to lay out the upper and lower profiles. Both of these profiles are easy to create using just a compass and a straightedge.

I cut the profiles at the band saw and then cleaned up the saw marks with a sanding drum and block plane. And with the profiles smoothed, you can finally lay out and cut the front notch at the top of each side, as shown below.

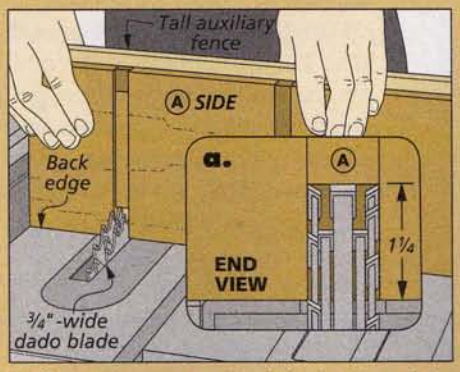
Shop Tip: Backrouting a Rabbet



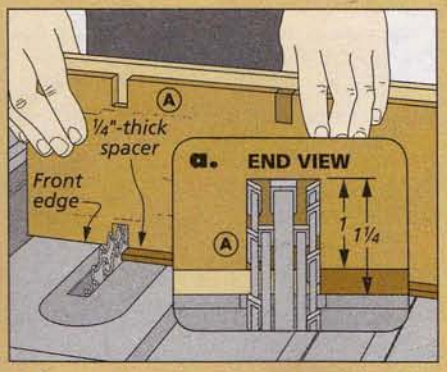
A Skim Pass. *To backrout a rabbet on the router table, set the bit to full height and adjust the fence for a very light cut. Holding the workpiece firmly, feed it from left to right.*



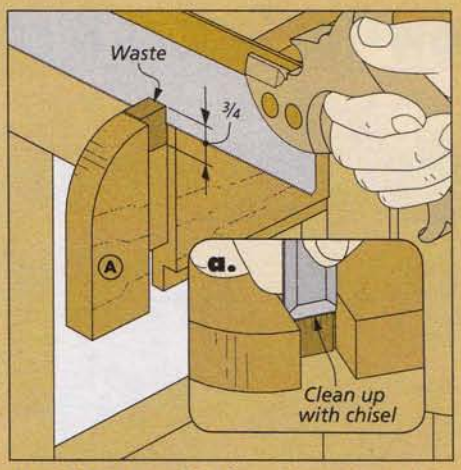
Right to Left. *Once the top shoulder of the rabbet has been established, you can complete the rabbet with normal right-to-left passes.*



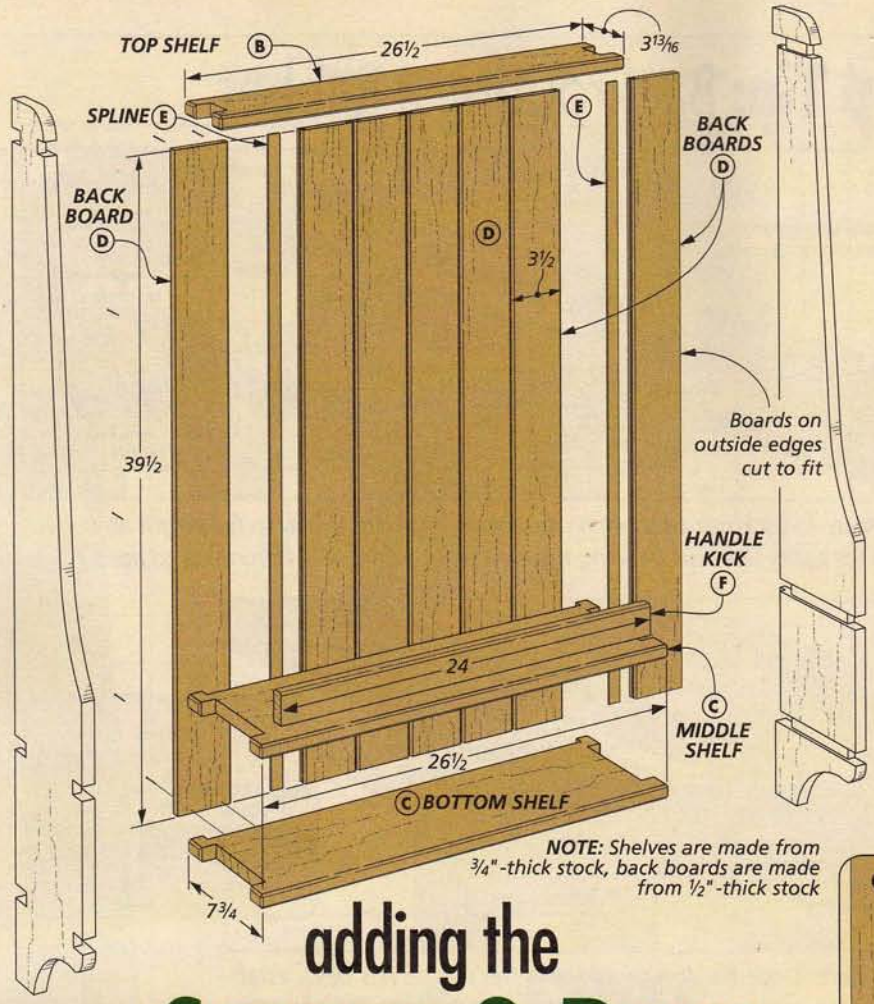
Tall Notch. *Next, I raised the height of the blade and used a tall miter gauge fence to cut the notch at the back of the side.*



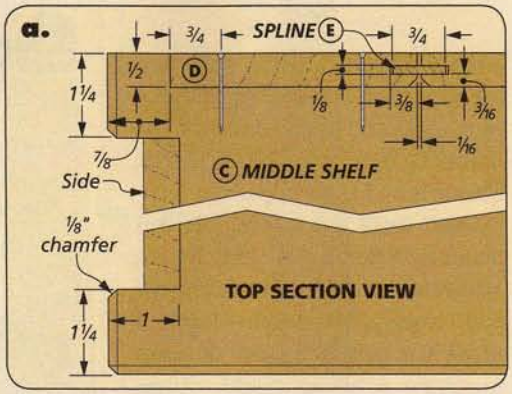
A Spacer. *You don't have to readjust the blade to cut the front notch. Just place a ¼"-thick spacer under the side.*

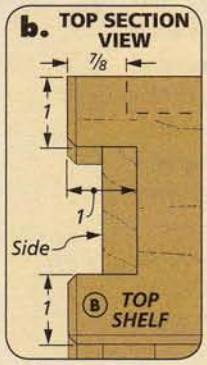


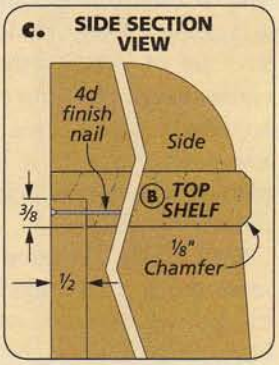
Hand-Cut Notch. *After shaping the sides, I laid out the top front notch and used a back saw and chisels to cut it to size.*

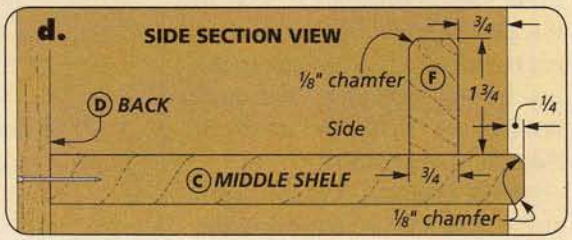


NOTE: Shelves are made from ¾"-thick stock, back boards are made from ½"-thick stock









adding the SHELVES & BACK

At this point, a lot of the hard work is done. Adding the three shelves and then the back is much less involved and goes quickly.

SHELVES. I started by cutting the top, middle, and bottom shelves to finished size. All the shelves are sized to stand ¼" proud at the front of the case with the tenons extending ½" beyond the sides.

TENONS. The next step is to form tenons on the ends of the shelves. This is done by simply cutting a large notch through the middle, leaving a tenon at each edge (details 'a' and 'b').

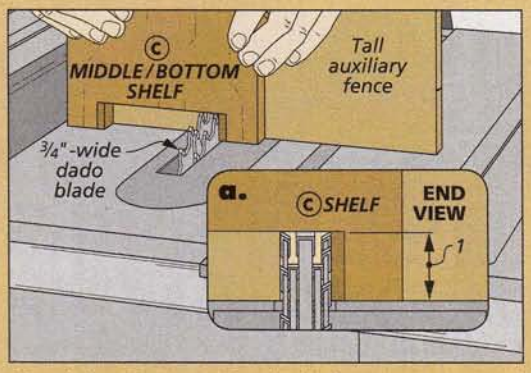
The technique I used to accurately size the tenons is shown in the box at left. A wide dado blade and a tall miter gauge fence are the key. The tall fence allows you to hold the shelf upright as it's passed over the dado blade.

The goal is to create a snug fit by matching the space between the tenons to the width of the notch in the sides. The fact that the tenons at the front and back of each shelf are identical in size simplifies this.

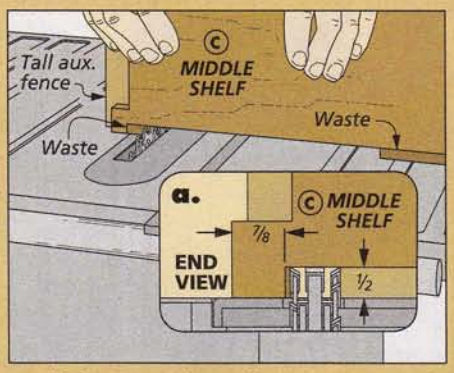
With the rip fence set as a rough stop, I started cutting in the middle and worked toward the edges. To perfect the joint, I made minor adjustments to the fence between test fits directly to the side. The same rip fence setting can be used for the two lower shelves. You'll have to reset it for the top shelf.

RABBETS AND A NOTCH. Once the joints are completed, the next step is to cut the joinery that will accommodate the back boards. The top and bottom shelf have a stopped

How-To: Tenons & Long Notch



Matching Tenons. *Set the rip fence as a stop and remove the waste with multiple cuts. Flip the workpiece side-for-side to create matching tenons.*



Multiple Cuts. *The quickest way to cut the long notch in the middle shelf is to make multiple passes over a wide dado blade.*

rabbet that ends flush with the shoulders of the rabbets in the sides (detail 'c,' opposite). I cut these on the router table, cleaning up the corners with a chisel.

But since the back boards run behind the middle shelf, as in the drawing on the opposite page, it needs a long notch. The table saw technique I used to do this is shown in the box on the opposite page.

CHAMFERS. Before assembling the shelves and sides, I swapped out the rabbeting bit in the router table for a chamfer bit. All the shelves have a 1/8" chamfer on the front edges and the ends of the tenons. It's safer to chamfer the short vertical edges of the tenons with a chisel and sanding block.

THE BACK BOARDS. Once the sides and shelves are glued together, the splined back boards can be made and added. The main drawing on the opposite page and the How-To box above provide guidance.

I will mention a couple of details. The boards are sized in width to create a 1/16" gap at each joint and 1/32" along the sides. And when you cut the grooves, note that the two outside boards only need a groove on one edge. And likewise, these two edges don't need a chamfer. Finally, I made the splines by ripping strips from the edge of a board.

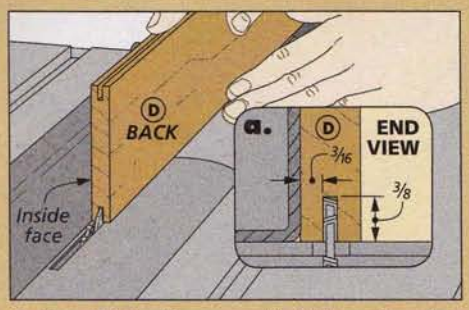
To install the back, I centered a small bead of glue on the ends of each board and nailed them in place. The splines simply float in the grooves (detail 'a,' opposite).

SAW HOLDERS. Now all that's left to do is outfit the case with holders, as shown in the drawing at right. The left side of the case is reserved for larger handsaws. First, I made a handle kick to fit between the sides and glued it to the middle shelf, as shown in detail 'd' on the opposite page. Then I screwed a slotted blade keeper to the back (detail 'c,' at right).

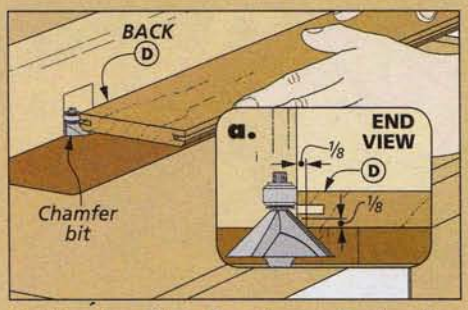
The right side of the till is arranged to hold large and small back saws. Three simple slotted racks positioned near the top cradle the smaller saws (detail 'a'). This leaves space below for a couple of larger saws. The large back saws hang on fitted handle blocks with turnbuttons, as in detail 'd.' And the toe of each saw rests in a grooved block below (detail 'b'). You'll find details on making the handle and toe blocks on page 26.

Once all these details were taken care of and a finish applied, I mounted the till in a prominent place using black lag screws and washers. If you're like me, admiring your tools is almost as enjoyable as using them. W

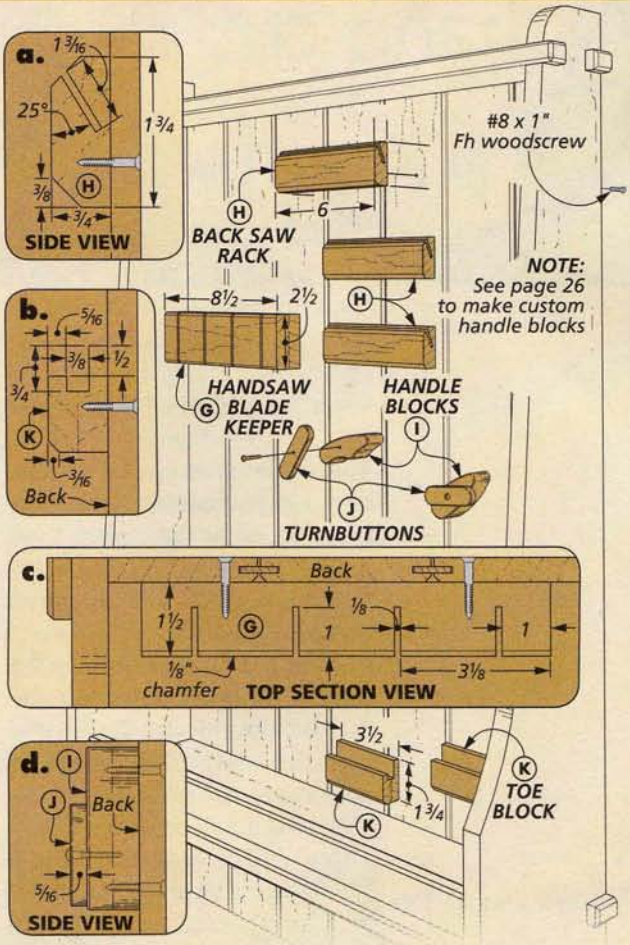
How-To: Back Board Details



Spline Slots. *To ensure that the spline slots in the back boards align, reference the inside face of each piece against the fence.*



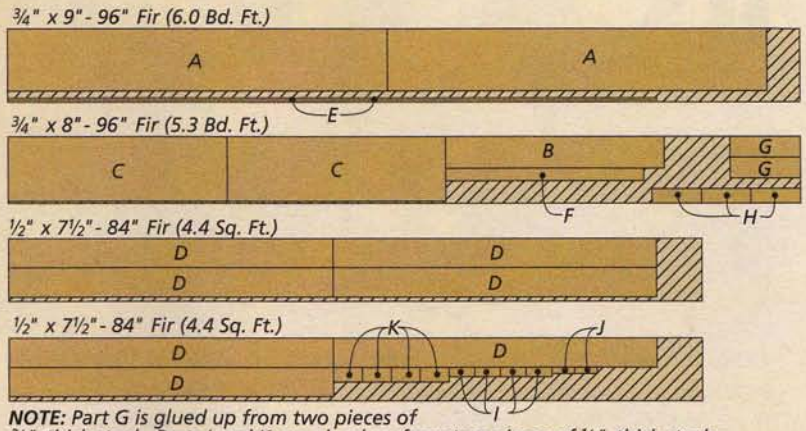
A Simple Chamfer. *A small chamfer routed on the edges of the back boards disguises the splined joint.*



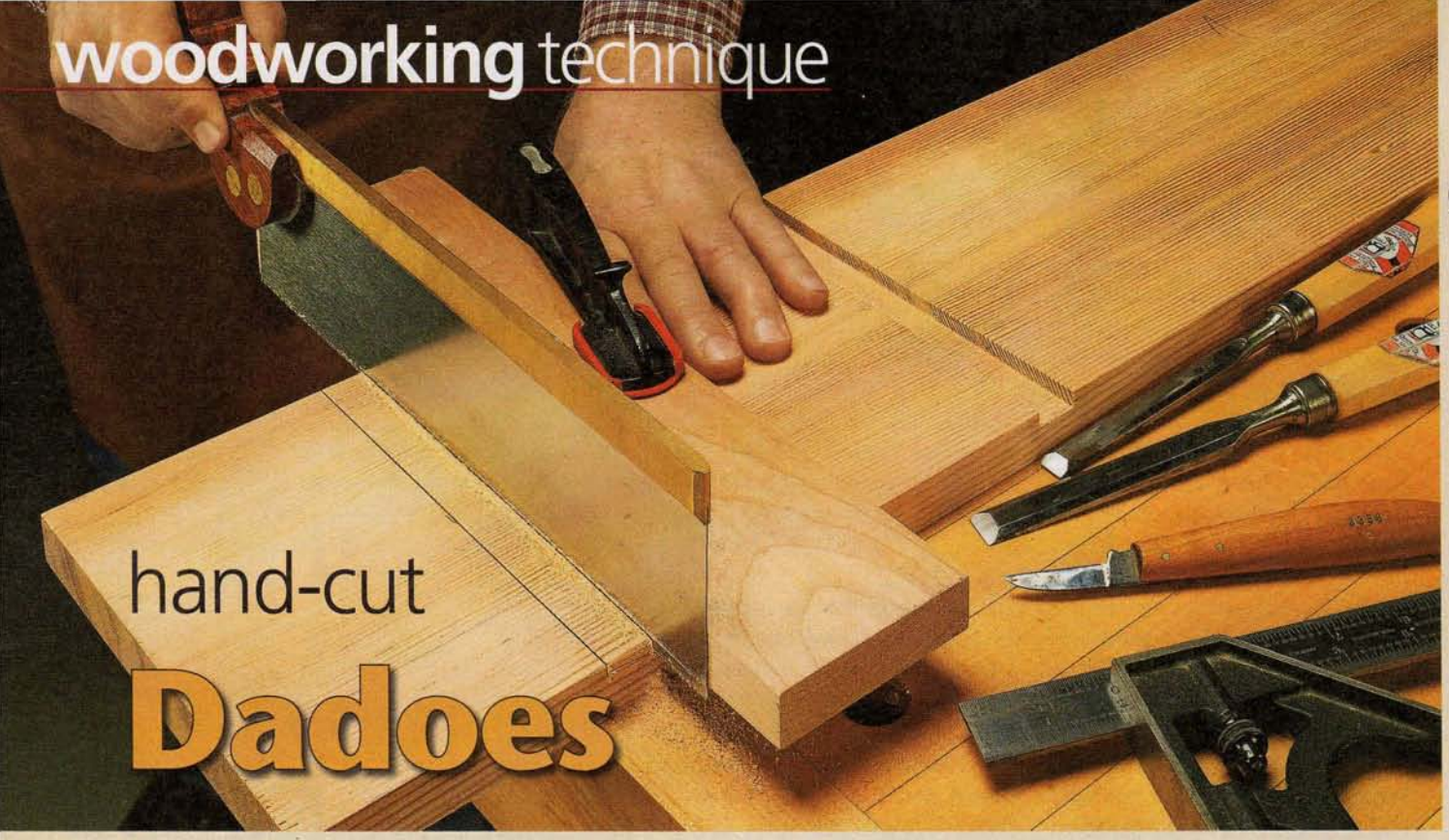
Materials, Supplies & Cutting Diagram

A	Sides (2)	3/4 x 7 1/2 x 46
B	Top Shelf (1)	3/4 x 3 13/16 - 26 1/2
C	Middle/Bottom Shelf (2)	3/4 x 7 3/4 - 26 1/2
D	Back Boards (7)	1/2 x 3 1/2 - 39 1/2
E	Splines (6)	1/8 x 3/4 - 39 1/2
F	Handle Kick (1)	3/4 x 1 3/4 x 24
G	Handsaw Blade Keeper (1)	1 1/2 x 2 1/2 - 8 1/2
H	Back Saw Racks (3)	3/4 x 1 3/4 - 6
I	Back Saw Handle Blocks (2)	1 x 1 1/8 - 3 1/8
J	Turnbuttons (2)	5/16 x 3/4 - 2 3/4
K	Back Saw Toe Blocks (2)	1 x 1 3/4 - 3 1/2

- (16) #8 x 1" Fh Woodscrews
- (2) #8 x 1" Rh Brass Woodscrews
- (4) 1/4" x 2 1/2" Sq. Hd. Lag Screws w/Washers
- (46) 4d Finish Nails



NOTE: *Part G is glued up from two pieces of 3/4"-thick stock. Parts I and K are glued up from two pieces of 1/2"-thick stock.*



hand-cut Dadoes

A few basic hand tools and an easy-to-master technique are all you need to cut clean, accurate dadoes the quiet way.

For me, the attraction of cutting dadoes by hand is the slow, quiet pace and the chance to do a machine-quality job with a few basic hand tools. To be honest, it's not a woodworking skill that's essential to master, but it is one that comes with a good dose of satisfaction. And as anyone who has ever tried this basic technique can tell you, it really isn't difficult.

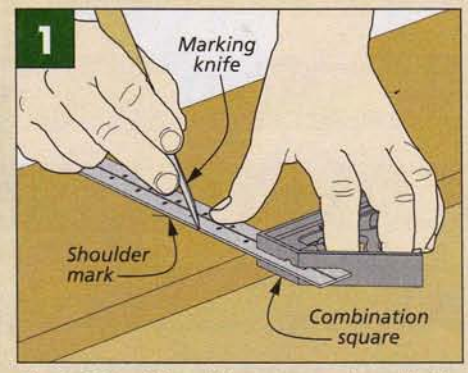
THE TOOLS. You'll only need a small assortment of tools for the job. Take a look at the photo above and you'll see the full complement: a combination square, a marking knife, a good-quality back saw, and a sharp chisel or two.

LAYOUT. With your tools gathered on the bench, the first step is to lay out the dado. The drawings along the bottom of the page show how to proceed with this.

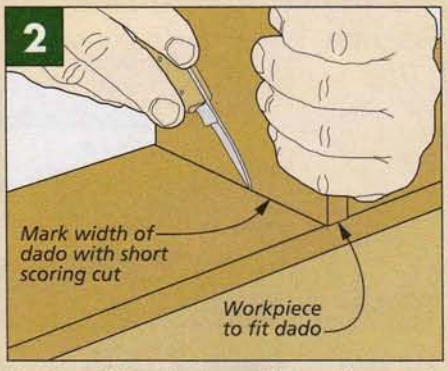
I score all of the layout lines with a sharp marking knife, as shown in Figure 1. A scored line is much more distinct and easier to follow than a pencil line. And the bonus is that it can serve as a "starting line" for your saw and chisel cuts.

The mating workpiece is used to size the width of the dado (Figure 2). And since the layout will guide all of your cuts, it needs to be thorough. So along with the top shoulders, mark the edge shoulders and the baseline (Figure 3).

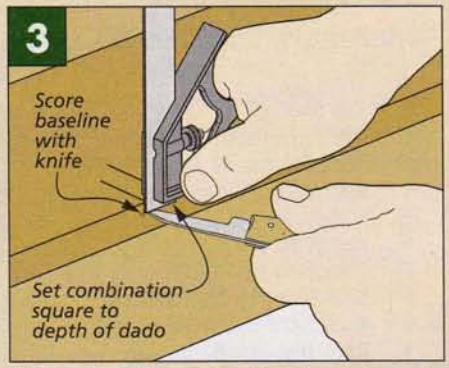
SAW THE SHOULDERS. Once the layout is complete, you're ready to establish the long shoulders of the dado with a couple of shallow saw cuts. This is best accomplished with help from a guide fence clamped firmly to the workpiece, as shown in the photo above.



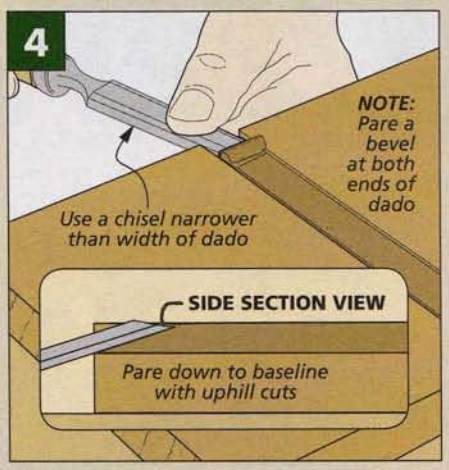
First Shoulder. *Measure and mark the location of one shoulder. Use a square and marking knife to score a sharp line.*



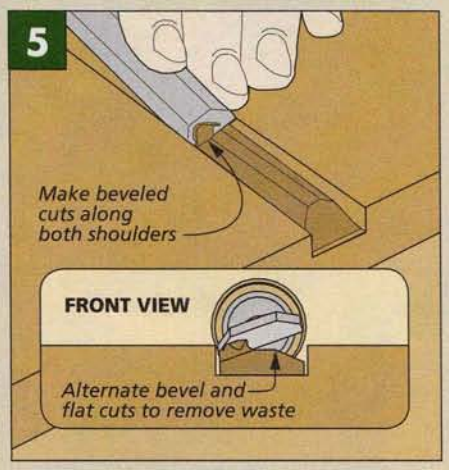
Custom Size. *Next, use the mating workpiece to mark the width of the dado. Then score a line with the knife and square.*



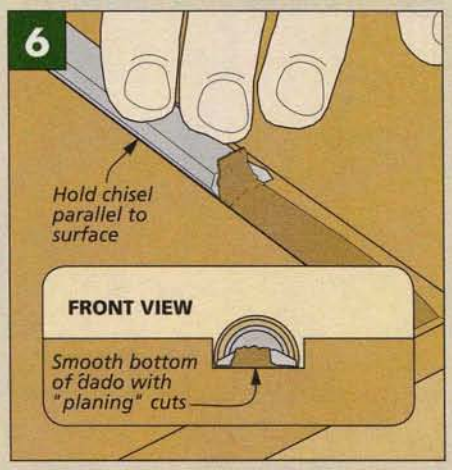
Mark the Baseline. *Set the square to extend the shoulder lines onto the edge and mark the baseline of the dado.*



The Ends. *Begin removing the waste between the shoulder cuts by paring a short bevel at both ends of the dado.*



Beveled Cuts. *Next, use beveled cuts along the shoulder lines alternating with flat cuts to pare away the center waste.*



Flat Bottom. *The final step is create a smooth, flat bottom. This is done by making light "planing" cuts with the chisel.*

The guide is simply a piece of wood with a perfectly straight edge that's square to the face. Position the guide to the outside of the dado with the edge directly on the layout line. The knife point or edge of a chisel can be placed in the score line to help locate the guide. Then clamp the guide down firmly.

As you saw down to the baseline, concentrate on holding the blade square against the guide. This will give you a kerf that follows the layout line and is perpendicular to the surface. As you near the baseline, go slow and check your progress at both edges. It's better to stop a hair shy than to cut too deep.

I like to flip the workpiece end-for-end to make the second shoulder cut. This allows me to position the guide and make the cuts in the same comfortable orientation.

PARE AWAY THE WASTE. With the two shoulders cut, you can exchange the saw for a sharp chisel to begin removing the waste. The chisel should be narrower than the dado so that you can work freely without fear of chipping or digging into the crisp shoulders. For a ¾"-wide dado, I use a ⅝"- or ½"-wide chisel. You'll be making mostly light paring cuts, so a mallet to drive the chisel is optional.

The goal is to create a dado with a flat, smooth bottom and a crisp, square baseline defining each end. The quickest way to accomplish this is to tackle the job using an easy-to-follow routine. The sequence of the chisel cuts that I make is shown in the drawings above.

You want to start by establishing the baseline at both ends of the dado. This is done by paring down to the score line with a series of short, "uphill" cuts, as shown in Figure 4. Angling the cuts upward allows you to remove the waste at the edges easily and quickly. The final cut at the baseline can be made with edge of the chisel seated directly in the scored line.

When you've completed the bevel at each end of the dado, you can begin to remove the waste from the center. And again, there's a simple method to this.

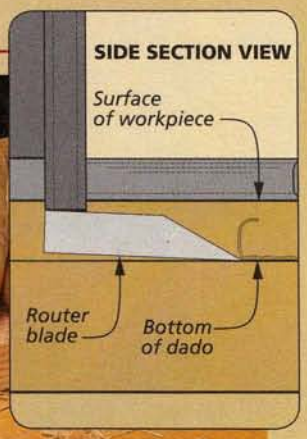
I start with careful beveled cuts along each shoulder, as shown in Figure 5. Several shallow cuts will leave a peak of waste through the middle that then be pared away quickly with a flat cut.

With alternating beveled and flat cuts, work down to the bottom. When you approach full depth, finish up the dado with light "planing" cuts, using the back of the chisel for reference (Figure 6). A combination square can be set to gauge the consistency of the depth.

Another way to clean up the bottom of a dado is to use a router plane (photo below). It makes achieving a smooth bottom with a consistent depth fast and foolproof.

You'll be surprised at how quickly the entire process goes as well as the quality of the result — not table saw speed, but surely a little more satisfying. W

Tools: Router Plane



▲ A router plane makes quick work of leveling the bottom of a dado. While the base of the router rides on the surface, the blade skims along the bottom, ensuring a consistent depth and leaving a smooth surface (detail drawing).

4 easy steps for perfect Surface Prep

One of the keys to a top-notch finish is to start with a well-prepared "canvas." I stick to a simple routine that guarantees a great result.

A high-quality finish starts before you ever open a can of stain or varnish. I've found that the simple surface preparation steps leading up to finishing can often make or break the end result. It's tempting to rush the process, but a little patience up front can make the finishing go easier and turn out better.

The goal is easy to define. You want to end up with a smooth, clean, consistent surface on which to apply a finish. To achieve this, I go through a systematic, four-step surface prep routine.

First, I search for and remove any glue spots or squeezeout. Next, I take care of any surface blemishes that might be noticeable once the finish is applied. Third, I give the entire project a final, pre-finish sanding. Finally, I clean the surface to remove sanding dust and any other debris that might interfere with a smooth finish.

1 NO GLUE. Glue spots and squeezeout are the bane of finishing. Glue on the surface blocks penetration of a stain or finish and creates an unsightly off-color blotch.

The best cure for glue blotches is prevention, of course. But this isn't always foolproof. To be absolutely certain there's no glue left on the surface, you need to perform a final "inspection and removal."

Start with a thorough examination of the most likely places — at or near the joints. Large beads of squeezeout are easy to find, but thin smears are harder to see. One way to make them stand out is to wipe the surface with mineral spirits (lower right photo).

Once I find glue, I go about removing it in a couple of different ways depending on the location. On flat surfaces, you can scrape or sand it off. If the glue is in the corner, I start by carefully paring away as much as possible with a chisel. Then I use a damp rag to soften and scrub away the rest. (Ordinary PVA glue can be removed with water and a little elbow grease.)

2 FIXING BLEMISHES. Visible dents, dings, or minor chips are almost inevitable. Sometimes a blemish is simply a small defect in the wood that you weren't able to work around.

Depending on the type of blemish, I approach it with one of two fixes. Shallow dents can usually be lifted with steam, as shown in the box on the opposite page. The steam causes the wood fibers to swell, leveling the depression.

If wood is missing or the surface has a natural defect, you'll have to repair it with filler. There are a lot of different formulations of wood filler. The two most practical for filling minor dings are the pre-mixed water-based and solvent-based types. Both come in a variety of

▲ Search for glue smears by wiping the surface with mineral spirits. The glue blocks absorption and stands out.

colors and dry quickly to a hard surface that can be sanded. They'll also accept stain to a degree.

I generally choose a color that's a shade darker than the wood in the project. The filler tends to dry lighter than what you see in the can. The flat tip of a screwdriver makes a precise applicator. Try to limit the amount of filler you spread to the surrounding area. It can fill the pores of the wood and show up once the finish is applied. When the filler is thoroughly dry (check it with a fingernail), you can easily sand it flush with the surface.

3 PRE-FINISH SANDING. When building a project, I sand parts and assemblies all along the way as I'm working. But this doesn't mean that once the project is complete, no further sanding is necessary. Before applying the stain or finish, I go over the entire project with a thorough pre-finish sanding. The goal is to create a consistent surface that will accept the finish evenly.

▲ Applying filler with a screwdriver avoids "spillover" to the surrounding area.

You may have scrubbed (with water) or scraped away glue, steamed out a dent or filled a ding. If these areas aren't sanded, they'll take a stain or finish differently than the surrounding area. A good once over with 180-grit sandpaper will "level the field."

At this stage, hand sanding is the way to go. You have better control. For large, open flat surfaces like a chest or tabletop, I wrap the sandpaper around a padded sanding block. For contoured or hard-to-reach corners, folded sandpaper works best, as shown above.

Since many surfaces won't need much attention, you can work quickly. But try to be thorough. Sand into the corners and don't overlook the narrow edges. Finally, gently ease any sharp edges. They'll hold the finish better and be less prone to damage.

4 REMOVE THE DUST. Now it's time for cleanup. Before you lay on a finish, you need to remove all the sanding dust and any other debris that may contaminate it. For me, this is a two-stage effort.

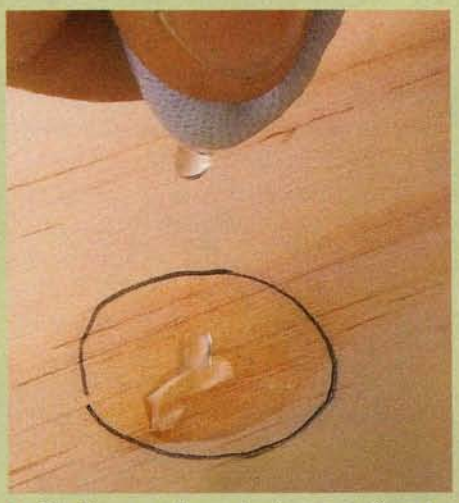
▲ A final, pre-finish sanding ensures a smooth, consistent surface. Here, hand sanding allows you to get into all the nooks and crannies.

To begin, use compressed air or a vacuum to remove the bulk of the dust. A vacuum with a soft brush is the tidier way to get the job done and is my preferred method (right photo). Compressed air may be quicker. But you'll want to blow off the project in a room separate from where you'll do the finishing.

A final dusting with a tack rag completes the job (main photo, opposite). The tack rag will pick up any remaining dust or debris and leave you with a clean surface ready for finish. And when the finish goes on, the wood will shine and your efforts will be rewarded. W

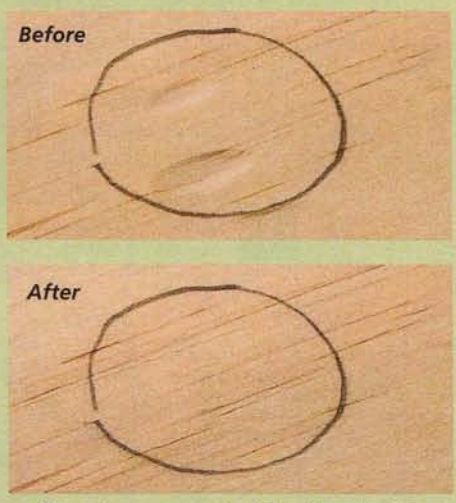
▼ A vacuum with a soft brush will pull the sanding dust from the surface pores.

How-To: Remove Dents with Steam

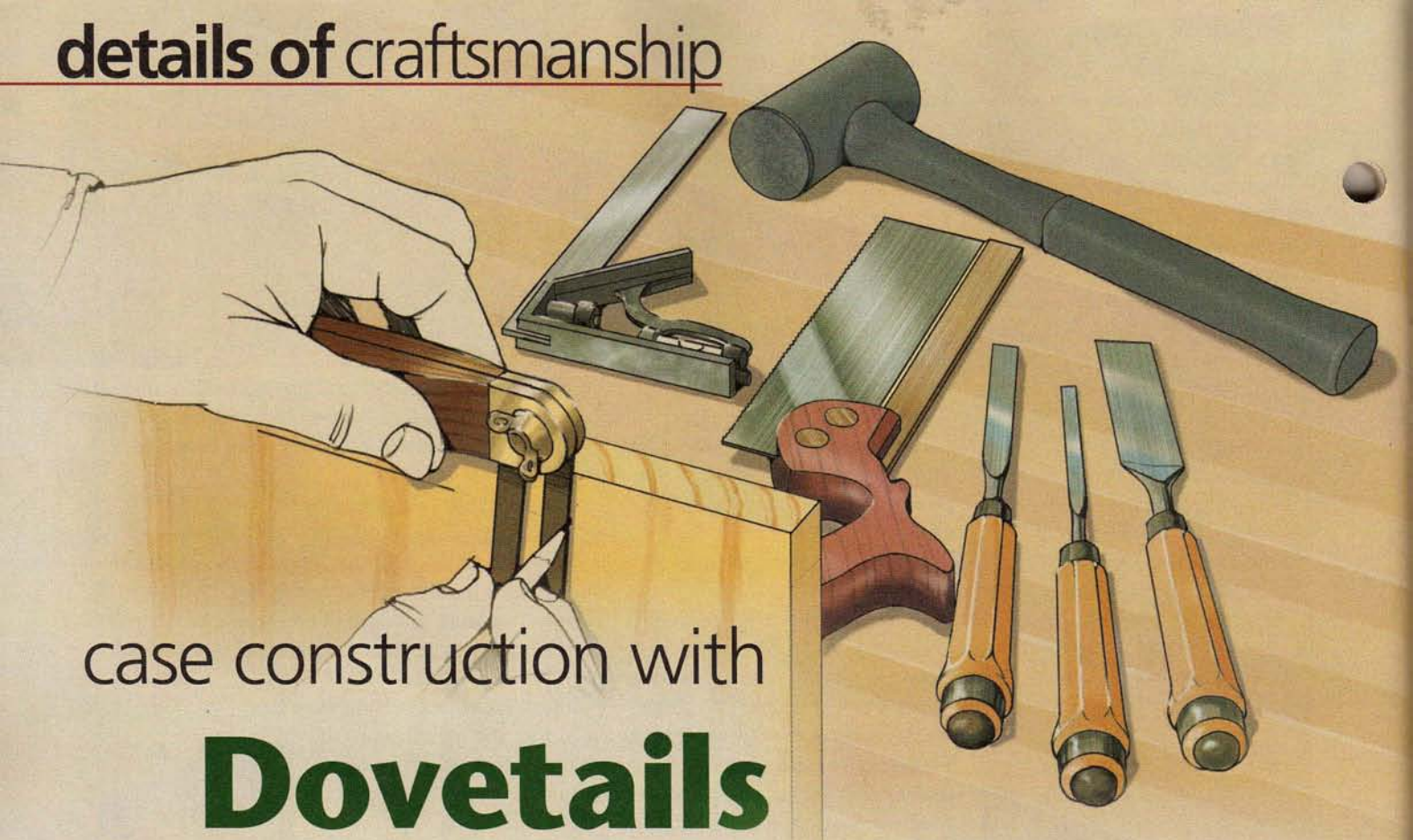


▲ Shallow surface dents can often be lifted with steam. You start by wetting the affected area.

▲ Place a dampened cloth over the surface and then apply a hot iron to force steam into the wood fibers.



▲ The steam created by the hot iron causes the compressed fibers to swell back into shape.



case construction with Dovetails

For long-lasting case construction, the tried and true dovetail joint can't be beat.

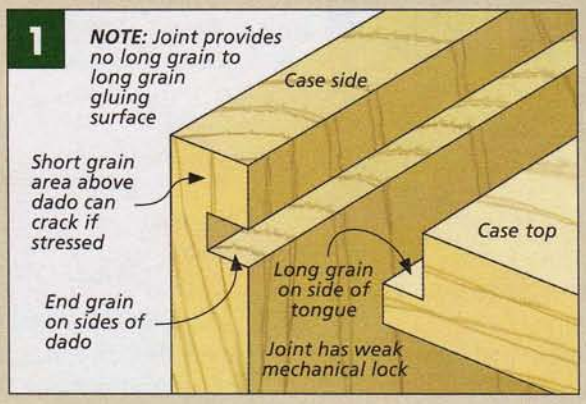
My first experience with dovetails involved building a drawer. This is a pretty common introduction for most woodworkers. But when it comes to uses for dovetail joinery, drawer construction is really just one of many. Another very important traditional use for dovetails was for solid-wood case construction. And the advantages and benefits of building with this type of joinery are still valid today.

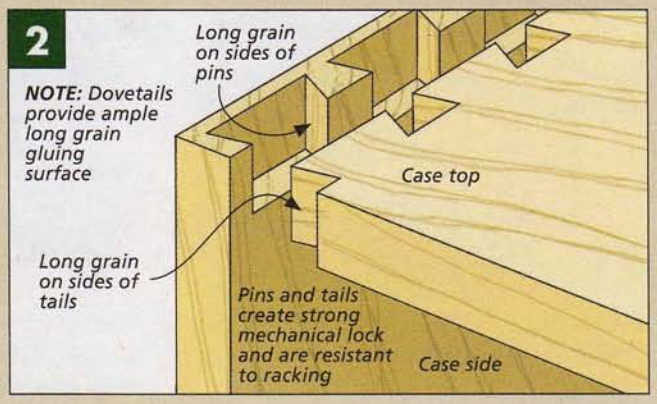
A COMPARISON. Whether machine-cut or hand-cut, dovetails can be more labor intensive than other joinery methods. So the pluses need to justify the extra effort. A simple comparison of joinery techniques should be convincing.

Think of the case for a chest of drawers or a cabinet as a big box — two sides, a top and bottom, and possibly some dividers. One way to join these parts at the corners is with a simple tongue and dado joint, as shown in Figure 1. This joint is quick and easy to cut and to assemble. When you're using plywood, this option gives you an adequate amount of long grain to long grain gluing surface, and results in a fairly strong joint.

But in solid wood construction, this joint is relatively weak. You have only end grain to long grain gluing surface and little mechanical strength or racking resistance.

Substituting dovetail joinery at the corners, as shown in Figure 2, overcomes all of these weaknesses. First, the sides of the mating pins and tails provides a large amount of good, long grain gluing surface. Second a dovetail creates a strong mechanical lock. Even without





glue, the joint has a great deal of holding power. Finally, a dovetail joint is extremely rigid. Once glued, it has a very high resistance to racking forces and results in the strongest possible case.

HALF-BLIND OR THROUGH. The purpose of using dovetail joinery is to create a solidly built and long-lasting case. The box below explains how the dovetails can be configured to accomplish this with a minimum of time and effort.

Both half-blind dovetails, as illustrated in the lower right drawing on the opposite page, and through dovetails (upper drawing at right) have a place in case joinery. Half-blind dovetails only show on one surface. This allows you to hide the dovetails under the case top or below the base. The disadvantage is that half-blind dovetails can be more difficult to cut and won't give you quite as much gluing surface.

Through dovetails can be left exposed and used as an aesthetic detail. Like a molding or a base profile, the joinery is meant to draw attention. This is a common feature of Shaker furniture.

Through dovetails are somewhat easier and less time-consuming to cut than half-blind dovetails. If left exposed, make sure the dovetails are a good fit. Or, they may also be partially or completely hidden beneath an applied molding and a case top (upper right drawing).

DOVETAILED RAILS. Dovetails can also lend themselves to more efficient case construction. If a separate top is going to be added to the case, you can substitute a pair of narrow rails dovetailed into the sides for a full-width panel (middle drawing at right). This arrangement still results in a rigid assembly while saving material and minimizing the weight of the case.

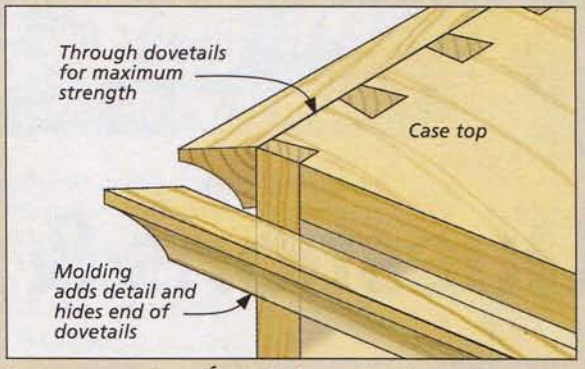
This option works well when the sides of the case are made with frame and panel construction. The narrow top rails are dovetailed into the vertical stiles of the sides.

The drawing shows two small dovetails on the end of the rail. This maximizes the gluing surface. Another option is to cut one large tail and install a woodscrew through it to reinforce the joint.

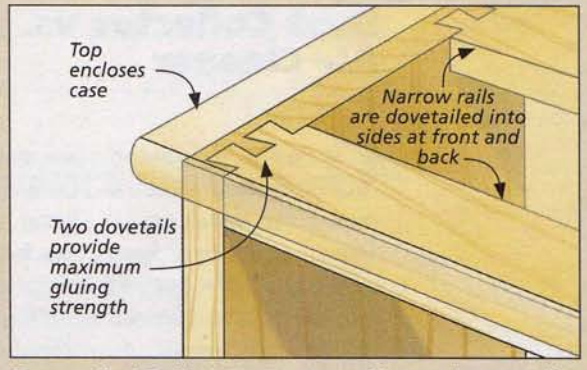
SLIDING DOVETAILS. Standard dovetails work very well for assembling a case with 90° corners. But what about case dividers or a bottom panel that's not flush with the ends of the sides. Here, a dado joint can be used, but you won't get a strong connection. A better choice is a sliding dovetail, as shown in the bottom drawing at right.

The advantage is derived from a strong mechanical lock. At assembly, the dovetailed end of the panel slides snugly into the flared housing creating a strong connection that doesn't rely on gluing strength.

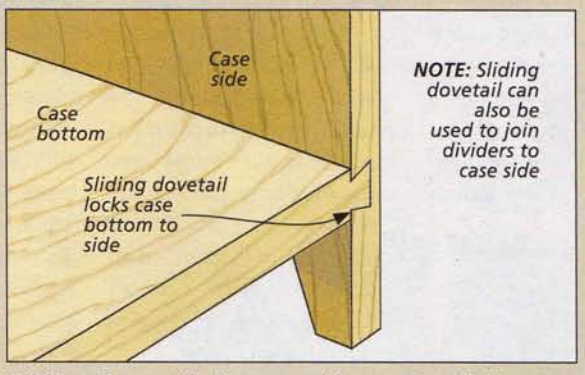
Knowing how and where to use dovetail joinery in case construction is certainly a valuable tool to master. You can rely on the test of time as the best proof of this. W



Strongest Joint. *Through dovetails provide a very rigid connection between the case sides and top.*



Dovetailed Rails. *You can save effort and material by substituting dovetailed rails for a full-width panel.*

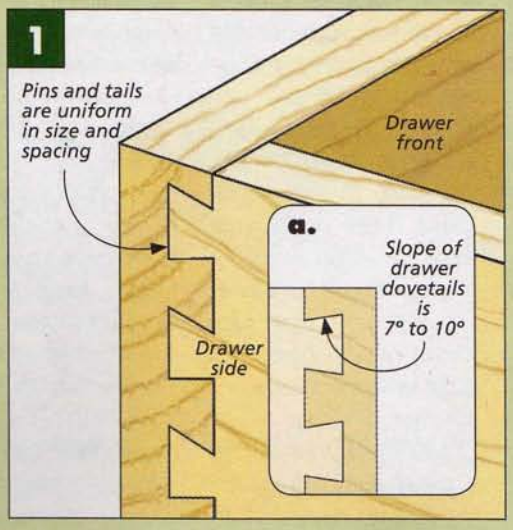


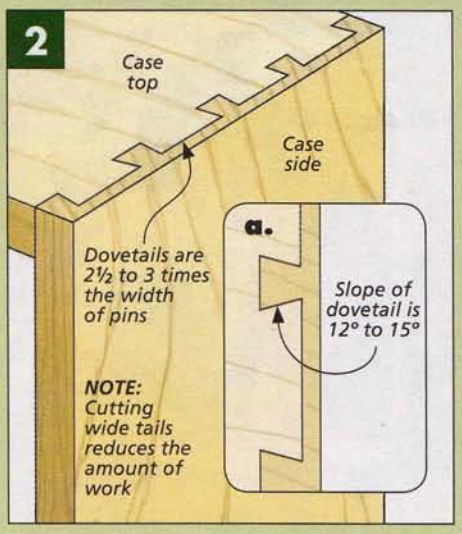
Sliding Dovetail. *A recessed bottom or dividers can be joined to the sides with a sliding dovetail.*

Dovetail Layout

The drawings at right contrast the layout of drawer dovetails and case dovetails. The pins and tails of drawer dovetails are generally more uniform, as in Figure 1.

Case dovetails can be made with proportionally wider tails — 2½ to 3 times the width of the pins (Figure 2). Cutting fewer tails means less work without sacrificing any strength. And for more holding power, you can lay out the tails with a greater slope, up to 15°.





Questions & Answers

Dust Collector vs. Air Cleaner

Q ***I'm considering installing either a dust collector or an air cleaner in my basement workshop. My budget only allows for one. Which do you recommend?***

Don Evans
Gansevoort, New York

A Dust control equipment is usually one of the last items on the list when setting up a shop. These "tools" are designed for a specific task. So it's a good idea to understand how they work before you decide which one to invest in first.

DUST COLLECTOR. Dust collectors (like the one shown at left) are designed to collect sawdust directly at the source. To do this, most tools today have a means of containing the sawdust and directing it to a dust collection port.

From there, the dust collector pulls most of the sawdust through the hose or duct to the collector unit. Heavy particles fall into a bag or container and finer particles are trapped by a filter or a finely woven cloth bag.

AIR CLEANER. An air cleaner unit is usually suspended from the shop ceiling (photo upper right) or mounted along a wall.

Rather than being connected directly to a tool, the air cleaner simply traps the fine dust floating in the air. A fan draws air through a filter at one end of the unit and then discharges the filtered air through the other end.

MAKING A CHOICE. At first glance, it may seem like the air cleaner is the way to go because it filters the air throughout the entire shop, not just from one tool at at time.

But air cleaners really aren't designed to take the place of a dust collector. They don't work too well for collecting the large amounts of heavier sawdust and chips produced by machines like table saws, routers, planers, and jointers.

And if you think about it, the goal of a dust control system should be to prevent dust from getting into the air (and your lungs) in the first place. Since air cleaners remove only airborne dust, it's a little like closing the barn door after the horses have gotten out.

That's not to say that air cleaners aren't useful. They're good for eliminating the clouds of fine dust that usually occur when sanding. This helps to cut down on the amount of fine, powdery dust that settles on tools, workbenches, and other items in a shop.

And if your shop is in a basement, an air cleaner can also help prevent dust from being drawn into your home's heating and ventilation system.

Despite these benefits, if I could only have one tool, I would definitely go with the dust collector. Then when the budget allows, I would add an air cleaner.

▲ An air cleaner does a good job of filtering dust particles out of the air, creating a more pleasant working environment in the shop.

▼ A dust collector is hooked up directly to a tool to remove dust at the source.

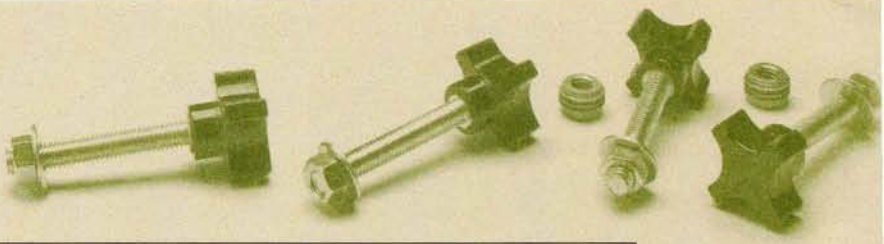
Do you have any questions for us?

If you have a question related to woodworking techniques, tools, finishing, hardware, or accessories, we'd like to hear from you.

Just write down your question and mail it to us: Woodsmith Q&A, 2200 Grand Avenue, Des Moines, Iowa 50312. Or you can email us the question at: woodsmith@woodsmith.com.

Please include your full name, address, and daytime telephone number in case we have questions.

Sources



SPECIAL-PURPOSE GLUES

You shouldn't have much trouble finding any of the glues discussed in the article on page 8. Just pay a visit to your local hardware store or home center. If you do have a problem locating a particular type, try the *Woodsmith Store*.

INSERT ROUTER BITS

Replaceable insert router bits, like *Amana's* new *In-Tech* line, might be the wave of the future. To be on the cutting edge, so to speak, go to *Amana's* web site to locate a dealer near you. Or take a look in the margin at right.

GRINDER TOOL RESTS

If you're sold on the benefits of upgrading the tool rest on your bench grinder, you can't go wrong with either option shown in the article on page 14. The *Wolverine Grinding Jig* is available from either *Woodcraft* (125676) or *Rockler* (24707). The *Veritas Grinding Jig* (05D13.02) comes from *Lee Valley*.

Another way to get better results from your bench grinder is to install a fast-cutting aluminum-oxide grinding wheel. You can purchase 6"- or 8"-dia. wheels in several grits from *Rockler*. The contact information is at right.

HAND-CUT DADOES

There are a couple of nice hand tools shown in the article on page 44 that may have piqued your interest. The back saw shown in the main photo is the small tenon saw offered by *Adria*. The *Veritas* router plane pictured on page 45 is available from *Lee Valley*. *Lie-Nielsen* makes a similar saw and router plane. Check the column at right for more information.

MANTEL CLOCK

Before starting on the mantel clock on page 16, I ordered the movement and a few other necessary items from *Klockit*. Here's what you'll need: a six-melody quartz chime movement (12161), a white Roman numeral clock face (26618), a set of hands (66992), a package of turnbuttons (39957), a 3/8"-dia. brass knob (39051), a pair of brass hinges (39212), and a magnetic catch (39011). You'll find contact information at right.

OAK BOOKRACK

You only need a couple of special hardware items to build the bookrack. The bottom shelf is attached with tabletop fasteners from *Rockler* (34215). I bought a section of steel rod at the hardware store to make the trough supports.

TRESTLE TABLE

Much of the hardware you'll need to build the trestle table can be found at a hardware store. But you'll have to order a couple of items. The table leaf fasteners (00S10.21) and the table alignment pins (00S10.04) can be purchased from *Lee Valley*.

PROJECT FINISHES

On two of the projects in this issue, I let the wood do the talking. The saw till and the oak bookcase are finished "naturally" with several coats of wiping varnish. This simple finish gives the wood a pleasing amber glow.

The finish on the trestle table requires two stains. The dark poplar base is stained with *General Finishes Java Gel Stain*. The cherry top was stained with our favorite custom mix — 3 parts *Zar Cherry Stain* to 1 part *Jel'd Cherry Stain*. I used this same mix to give the desk clock its warm, aged look.

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MAIL ORDER SOURCES

Project supplies may be ordered from the following companies:

Woodsmith Store
800-444-7527
Grinding Wheels, In-Tech Router Bits, Special-Purpose Glues, Wolverine Grinding Jig

Adria Tools
604-710-5748
adriatools.com
Back Saws

Amana Tools
800-445-0077
amanatools.com
In-Tech Router Bits

Klockit
800-556-2548
klockit.com
Clock Hardware, Clock Movements

Lee Valley
800-871-8158
leevalley.com
Grinding Wheels, Table Leaf Fasteners, Table Alignment Pins, Veritas Grinding Jig, Veritas Router Plane

Lie-Nielsen Toolworks
800-327-2520
lie-nielsen.com
Back Saws, Hand Tools, Router Plane

Oneway
800-565-7288
oneway.ca
Wolverine Grinding Jig

Rockler
800-279-4441
rockler.com
Grinding Wheels, Tabletop Fasteners, Wolverine Grinding Jig

Woodcraft
800-225-1153
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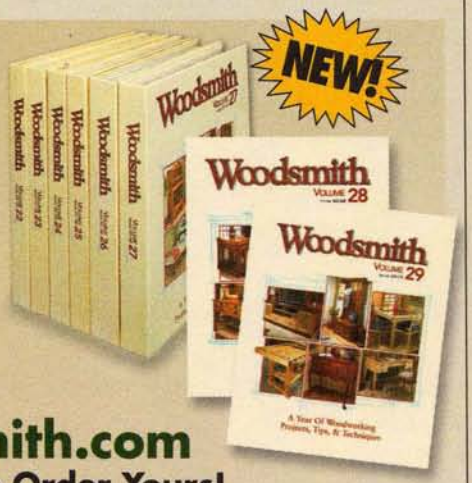

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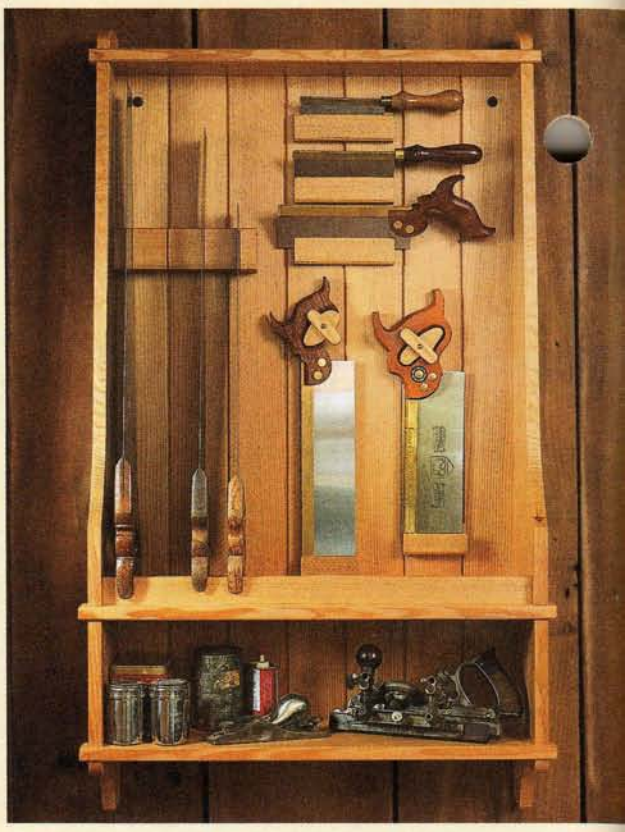
looking inside
Final Details

► *Oak Bookrack.* If you're looking for a project that features versatile storage along with a compact, stylish design, this might be the one for you. Check it out beginning on page 20.



▲ *Handsaw Till.* This practical shop project protects and stores your hand saws in traditional style. And the bonus is a chance to show off your woodworking skills. The plans start on page 38.

▲ *Mantel Clock.* This eye-catching clock has many of the classic details of its larger cousins. But the small scale makes it much more manageable to build. Turn to page 16 and we'll show you how it comes together.

▲ *Trestle Table.* Although true to the traditional design, this sturdy trestle table has been updated with softer lines, plywood construction and a two-tone finish. Plus, with a pair of drop-in leaves, the table can be expanded to seat eight. You'll find more on page 28.